RAILROAD GAZETTE

FRIDAY, JUNE 5, 1896.

CONTENTS

Contributions.

Killing Weeds and Grass on Right-of-Way.

PUERTO BARRIOS, Guatemala, May 9, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Can you, or any of your readers, give any information regarding a successful weed and grass killer for railroad work? What has become of the electrical weed killer from which so much was expected? I have not read anything about it lately. I have been informed that the Atchison, Topeka & Santa Fe have used successfully a hot solution of salt for killing grass and weeds. Can any one inform me if this is correct, and how it is done? We have here 60 miles of road where the rainfall exceeds 100 in. a year, and it is distributed over the whole year so that the grass grows continuously, and grass cutting is by far the largest expense on the maintenance of way.

I should be very glad to hear the experience of others regarding the destruction of weeds and grass.

SILVANUS MILLER.

Chicago, Rock Island & Pacific Railway Co.,
DAVENPORT, IA., May 25, 1896.

The only practical destroyer of weeds we have ever seen in this country is a locomotive engine with a device in the front by which the flame and steam are blown through the front end over and directly on top of the weeds. This invention was patented by D. Hawksworth, Superintendent Motive Power, Burlington & Missouri River, and was used for several years on the Burlington. I do not know whether they are using it yet or not. The electric device was taken up by the Illinois Central, and, I believe, never proved practicable. [A more detailed account of this will be given in a later issue.—EDITOR.]

I doubt if any device would work in a country where there was so much rainfall as in Guatemala. If rock salt were plenty enough, so that it could be crushed and spread over the track, weeds could be kept down in this way, but of course for this rock salt must be mined at a very reasonable expense. The weed burner I speak of would keep the weeds down successfully, but it was used in a country where the ground was quite dry, and I doubt if in a country where it is liable to rain every day, it would sufficiently cook the weeds to kill them.

W. K. MCFARLIN,
Supt. Maintenance and Construction.

Burlington & Missouri River Railroad in Nebraska,
LINCOLN, Neb., May 30, 1896.

We do not know any cheap way of killing weeds. After trying for several years to burn them we have decided that the cheapest way to remove them is by man power, with shovels. We have never tried to destroy them by salt or any other chemical solution.

Cinder ballast seems to act as a preventive; weeds do not grow in it easily. Slag ballast is also an excellent weed killer. On parts of our Nebraska lines that are ballasted either with slag, cinders, gravel, broken stone or burnt clay we have had no trouble for the last five or six years.

I. S. P. WEEKS.

The Atchison, Topeka & Santa Fe Railway Company,
TOPEKA, Kan., May 26, 1896.

This company several years ago made a trial of killing weeds with a solution of salt; it was not heated, however, but was a brine taken from the salt wells at Hutchinson, Kan., and placed in a water car with a sprinkling attachment and run over the road. As to killing the weeds it was very successful, but it caused a slime on the rail, making it impossible for engines to pass over on account of slipping, and it was also found to cause rusting of the steel, and we were obliged therefore to discontinue it.

H. U. MUDGE,
General Superintendent.

The Joint Traffic Association Sustained.

The suit of the Government for an injunction declaring the Joint Traffic Association illegal has failed, Judge H. H. Wheeler, in the United States Circuit Court at New York having dismissed the bill on May 28. The course of this suit is familiar to our readers. At the request of the Chairman of the Interstate Commerce Commission, the United States District Attorney at New York made complaint last January that the agreement under which the Association acts was a restraint upon trade, and, therefore, an infraction of the anti-trust law of July, 1890, and also that the clause of the agreement authorizing distribution of traffic was contrary to the fifth section of the Interstate Commerce law. The arguments in the suit were reported in the *Railroad Gazette* of May 15 and 22.

The substance of the decision follows:

This bill is brought at the request of the Interstate Commerce Commission, under the direction of the Attorney-General, by the District Attorney of the United States for this district, against this agreement, as made, without counting upon any statutes, or alleging anything actually done under it to be of itself unlawful otherwise than because so done. The answer denies, as a conclusion, any illegality within or under the agreement; and, as a matter of fact, anything unlawful outside of or beyond it. The case has been heard upon the bill and answer, and so is made to turn upon the question of the legality or illegality of the contract, and upon the right of the United States, as plaintiff, to maintain this suit, if it is illegal. The provisions of the contract stated are understood to be the ones challenged as being contrary to the statutes quoted.

The restraint and monopoly act expressly authorizes such a proceeding in equity as this to prevent its violation, and this suit is well maintained if this contract is within it. Railroads are not expressly named in this act, and are said in argument not to be within its terms. No one is so named, but it applies to all contracts and combinations in restraint of trade or commerce among the states. Railroads do not trade among the states, but they carry for those who do, and what would restrain them so carrying would seem to be a restraint of such commerce. The provisions of the contract do not provide for lessening the number of carriers nor their facilities, nor for raising their rates, except expressly by its terms not contrary to law, and therefore not beyond what are reasonable. The Interstate Commerce law, Section 1, requires all rates to be reasonable, and the making of reasonable and lawful rates upon carriage in any traffic cannot be any restraint in law upon such traffic. The soliciting of custom is no part of the duty of common carriers, and dispensing with soliciting agents or with the control of them cannot be illegal, nor an agreement to do so be an illegal contract. As this case rests wholly upon the contract as made, and not anything actually done under color of or beyond it, and each road is left by it to carry on its business within lawful limits as before, no unlawful restraint of commerce seems to be provided for by it and no ground for relief under that statute of 1890 is made out.

No provision is made by the Interstate Commerce law for enforcing its provisions in equity, except to carry out orders of the Commission; and authority for this suit to restrain any violation of that law must appear otherwise or fail. That Governments and states exercising general municipal control over the people, their property, their rights and their convenience may, by their law officers, maintain suits in equity to restrain actual nuisances to ways, parks, commons and the like, which are injurious to the common rights of all to their enjoyment, is not to be questioned. The United States Government is limited in such control to such particular subjects as are committed to it, which include of course interstate and foreign commerce, carrying the mails and such. These railroads are not Federal instruments, although they may be and probably are engaged in the business of, and are within the control of the laws of the Government to some extent. As so engaged no nuisance would be Federal till it should become actual by obstructing these functions. This contract, if illegal, is intangible, and is not alleged or claimed to have obstructed the roads for Government purposes in any manner whatever.

The United States may maintain a bill in equity to repeal a patent for land (U. S. vs. San Jacinto Tin Co., 125 U. S., 273) or a patent for an invention; and a state, to protect its interest in components of the soil under its navigable waters, or to prevent abuse of charters granted by it, because of the interest in the property as proprietor, or in the grant as a party to it. But here the United States is not alleged, or understood, to have granted the charters of or to have any proprietary interest in any of these railroads, or to have any other concern about them, in any respect involved here, but to have its prohibitory statutes for regulating commerce between the states respected and obeyed, the same as that those against counterfeiting or tampering with the mails should be. Breaches of such statutes are misdemeanors, punishable by indictment or information and that merely such are not presentable in equity is elementary. A plaintiff in equity for relief by injunction should have some right or interest in the subject of prevention, or be given express authority to proceed in that way by statute. Authority is given to the Interstate Commerce Commission to have proceedings for the enforcement of that law taken and prosecuted, but that is understood to refer to the usual and appropriate proceedings in such cases, and seems not to authorize any that are unknown there. The right given here is to prosecute, but not to provide remedies.

If this is erroneous, only such agreements are prohibited as are for the pooling of freights or dividing aggregate or net proceeds of earnings. So far as this agreement goes, each road carries the freight it may get over its own line, at its own rates, however fixed, and has the proceeds, net or other, of the earnings to itself. Very able judicial opinions and learned commentaries and disquisitions upon pooling, too numerous for separate notice herein, have been referred to, but none make it include what is left in wholly separate channels. Provision for reasonable, although equal or proportional rates for each carrier, or for a just and proportional rate for each carrier, or for a just and proportional division of traffic among carriers, does not seem to be either a pooling of their traffic, or freights, or a division of the net proceeds of their earnings in any sense.

This statement of reasons seems quite inadequate to the very full and able argument upon which this case has on each side been presented; but these conclusions have been reached upon full consideration of all, so far as understood; and as they appear to be sufficient for the disposition of the case, no more is attempted. Bill dismissed.

The St. Louis Tornado.

On May 27 at 5:15 p. m. the city of St. Louis, Mo., was visited by a most disastrous tornado and wind and rainstorm. The high wind and heavy rain were general throughout the city. The destructive tornado cut a wide swath through a closely built residence section of the southern part of the city, but fortunately missed the central business portion where the high office buildings and large stores are situated.

The appended report from the *Post Dispatch* gives an official account of the storm written by Mr. H. C. Frankenfield, who is in charge of the United States Signal Service station in St. Louis. From this it is seen that at 5:15 the velocity of the wind was 80 miles an hour, that 1.33 in. of rain fell from 5:04 to 6:04 p. m. and in the ten minutes from 6:25 to 6:35 there was a rainfall of 0.62 in. From 5:04 to 9:05 there was a total rainfall of 3.04 in. The barometer fluctuated rapidly and showed a maximum sudden variation of 0.40 in.

There was very little damage done in the neighborhood of the Signal Service station, which is in the central district of the city, about a mile north of the path of the tornado. These figures therefore give but a slight idea of what the conditions may have been where the greatest destruction occurred.

In the three days which have passed since the storm the city authorities, street car companies and citizens have worked with tireless energy and brought some semblance of order out of the general chaos. The street department has cleared miles of streets and opened them for traffic again; the street car lines are still badly crippled, but much of the machinery was found in good order when the débris was cleared off, and the lines are in partial operation.

Trains are running over both bridges. The Merchants' Bridge is several miles north of the path of the tornado and was not injured at all. Trains via the Merchants' Bridge, however, must pass through the city over the Elevated Road, which is in the direct path of the storm; and though the structure was not damaged, traffic was interrupted till the débris from adjacent buildings which had fallen on the track could be cleared off. Trains were running by 11 o'clock that night.

The Eads Bridge proper was also uninjured. A section of the wooden floor of the upper roadway on the center span was carried away, and the masonry approach at the east end was partly destroyed above the level of the railroad tracks, as described later. This caused some interruption of railroad traffic on the Eads Bridge, but the Terminal Railroad officials have been working day and night with such energy that the track was cleared and trains running into Union Station within 24 hours after the storm. Team traffic on the upper roadway will be resumed on a temporary structure by Monday.

An estimate of the actual damage is at this time impossible. The area covered is so large and the interests involved are so many that any figures must be in the nature of a guess. The commercial agencies have declined to give any figures till they have had time to compile data on which to base an estimate. The local papers now state the probable loss for St. Louis at $5,000,000 to $10,000,000, and for East St. Louis from $2,000,000 to $5,000,000.

The loss of life has been greatly overestimated, as at first every one missing had been reported as dead. An accurate list can only be made in time from the records of the health department, as no body can be buried without a permit. So far 101 permits have been issued for St. Louis and it is variously estimated that from 150 to 200 will cover the total number. One of the first buildings to collapse was a part of the City Hospital and it is estimated that over 50 patients were buried in the ruins. The ruin of the City Hospital made it particularly difficult for the authorities to care for the many injured, as temporary quarters had to be found to accommodate them. In East St. Louis nearly 100 burial permits have been issued, and the probabilities are that quite a large number will yet be found under the ruins.

The section of the city in the path of the tornado included the Lafayette Park and Compton Heights districts, which cover some of the finest and best-built

residence sections in St. Louis. In this district the storm must have exerted its greatest power, as the park is utterly devastated and not a house near by has escaped some injury. It is noteworthy that very few houses were entirely destroyed and few people killed in this district. From Lafayette Park to the river the path of the storm is through a poorer and older residence section of town, which has many large factories and manufacturing plants scattered through the area. It is in this section that the deaths are numerous, as many of the old houses collapsed entirely and buried the inmates.

It cannot be said that the strong buildings were better able to resist the tornado than their weak neighbors. No building can stand entirely against such force. But on the average it would appear that a good building will stand a better chance of failing only where struck by the capricious vagaries of the tornado, while an old or weak building may collapse entirely or be blown down afterward by the wind.

The craft on the river were torn loose from their fastenings, some overturned, some blown on shore, or otherwise badly injured.

East St. Louis presents the worst appearance. Being lighter built, with many frame structures, it offered less resistance to the storm, and is almost a total wreck. Long lines of freight cars have been overturned; cars on the same track often thrown in opposite directions, showing the action of the "twister."

After the first impression of horror and dismay over the death and desolation caused by the storm, the mind of the spectator becomes fascinated by a detail study of the work of the elements, and is appalled in contemplating the awful and instantaneous power which must have been exerted to produce the results to be seen on all sides.

AS SEEN BY THE ENGINEER.

Two things are specially noticeable and interesting from an engineering standpoint:

First. That the destructive work is done not so much by direct wind force as by lifting or suction action, or, more correctly speaking, by the unbalanced force due to unequal atmospheric pressures.

Secondly, the many unexpected and fantastic places and ways in which this force has been exerted.

To form some estimate of probable power due to different atmospheric conditions the writer made enquiries at the Signal Service station. During the storm the barometer fluctuated rapidly, the maximum variation being 0.4 inches. This was a sudden drop and immediate recovery of the mercury at about a mile from the center of the storm. In the opinion of the signal officer the probable variation at the storm center would be 3 in. Differences of 2.7 in. have actually been observed in storms in the Southern Pacific Ocean. This barometric variation reduced to pressure would mean that at the Signal Service station the pressure of the atmosphere suddenly varied 28 lbs. per sq. ft., and in the storm center the probable variations in pressure are 210 lbs. per sq. ft. With the enormous velocities which occur in the spiral of the tornado these variations take place instantaneously.

Such an assumption is certainly in accord with the results of the action of the tornado as observed in innumerable cases. Sections of walls of any imaginable form or size, varying from a dozen bricks to the entire side of the house are gone, and the debris is on the *outside*. The material has been pushed out from that left standing as sharply as though taken out by a punch and die, or cut by huge shears. Generally the roofs have been lifted and thrown to one side with the top section of the walls; often a panel of wall with adjacent windows has been punched out; in many cases the face brick have been peeled off, and the backing left standing. No imagination can conceive the various and multiform phases of the destructive force.

Some instances have been particularly noted by the writer, and may be given more in detail:

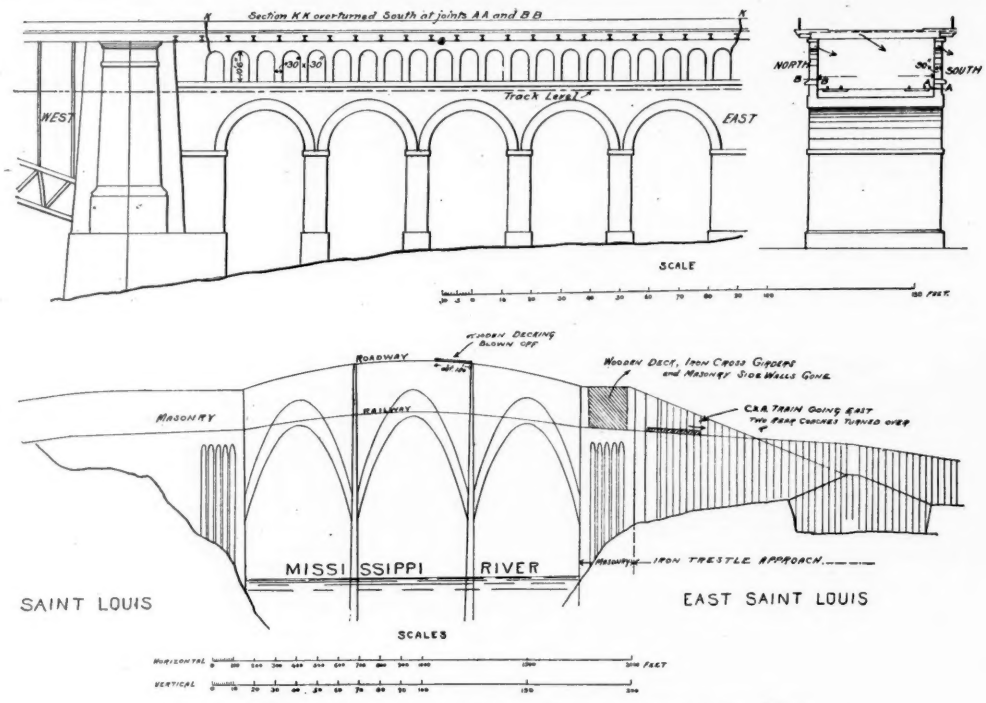
In Lafayette Park trees 2 ft. in diameter have been torn out by the roots and thrown over; others bent and twisted off close to the ground; others have had every branch broken from the trunk, and trees close together have been thrown down in opposite directions. Scarcely a single tree of this beautiful park is left standing.

The north wall of a large brewery was torn bodily from the rest of the building and fell out into the street. The rest of the building is intact. This wall was about 40 ft. wide, 80 ft. high, built 13 in., 18 in. and 24 in. thick, of brick laid in cement mortar.

The smokestack of the power-house of the Scullin railroad system was broken off about 40 ft. above the ground and thrown over. This stack was considered one of the most substantial in the city. It was built of brick laid in cement mortar and had double walls. The stack was 162 ft. high above the ground, 21 ft. diam. at the base and 10 ft. 6 in. diam. at the top. The outer brick wall was 17½ in. thick at the base and tapered to 9 in. at the top; the inner wall was 9 in. thick at the base and tapered to 6 in. at the top. The remains of the stack stand like a huge stump, entirely sound except several cracks reaching about 5 ft. below the fracture.

The destructive work of the storm at the Eads Bridge gives more striking evidence of the lifting power of the tornado. The upper or wagon roadway of this bridge consists of an iron framework of cross girders, which is secured to posts rising from the main arches. On these is built a wooden floor of 6×14-in. stringers, 3-in. planking and 4½ in. wooden paving blocks. The ironwork is intact, but a section 150 ft. long of the woodwork has been lifted up and carried away. Next to this gap, on each end, several sections of flooring have been lifted and pushed to one side or the other and dropped again. Beyond these, where the force was apparently not so great, the stringers and planking have not been moved, but numerous patches of the blocking have been raised and blown away or dropped in irregular heaps. These patches of blocks can be followed quite a distance from the main gap, the size of patch becoming smaller, and then beyond are spots where the blocks have simply been raised slightly from the planks.

At the east end of the bridge a section about 250 ft. long is built of masonry. The upper roadway is of the same construction as on the bridge proper. The iron cross girders which span over the railroad tracks are supported on masonry side walls about 16 ft. high and 2 ft. 6 in. thick. The walls are built of a series of arches, about 6 ft. span and 10 ft. 6 in. high. The pillars between the arches are 2 ft. 6 in. ×2 ft. 6 in. and stand on solid wall 2 ft. 6 in. thick, which stands about 3 ft. above the level of railroad tracks. The cross girders carrying the upper roadway rest on top of these side walls, centering over the pillars, and are anchored by 1-in. bolts. This section of roadway, girders and masonry walls about 180 ft. long was lifted and thrown over. It is noteworthy that although the tornado approached from the south the structure was thrown *towards* the south. All of the south wall and the floor and girders at the center were thrown over the south side of the bridge to the ground and river below. The north wall overturned at the base of the pillars and fell on to the tracks with the rest of the girders and flooring. It was this débris that delayed trains on the Eads Bridge. The masonry was all first-class cut stone in large blocks. A Chicago & Alton train consisting of engine and four coaches going east was on the north track of the bridge when the storm struck the river. The engineer saw a steamboat thrown against the bridge pier and put on full steam to reach the east shore. Just as the train passed beyond the east tower on to the trestle approach the last two coaches were overturned. The other coaches and engine did not leave the track.



Sketches of Eads Bridge, St. Louis, Showing Portions Injured by the Storm.

The writer has been looking diligently to find any evidence of the effect of the storm on some example of structural steel work, but no modern steel framed building or bridge work came in the direct path of the tornado's extreme force. The following instances of effect of wind on iron work have been noted:

In the western part of the city the Liggett & Meyers Tobacco Co. have in course of erection a group of large 5-story buildings. The buildings have heavy brick outside walls and interior frame work of steel beams and cast iron columns. Three of these buildings had all iron work in place and bolted, but walls only one story high. These building are about 100 ft. wide, 200 ft. long and stand end to end close together. The framework in the two end buildings was struck by the storm and collapsed —many cast iron columns 10 in. diam. × 1 in. breaking and the girder work settling floor upon floor in one great intricate mass of bent and twisted ironwork. The central building escaped entirely, the storm not even disturbing a pile of loose plank lying on top of the building.

In a long series of trolley poles on one of the electric lines every pole was bent over into the street. The poles are 6-in. steel tube, set in concrete bases and bent at the ground line.

Probably the most remarkable evidence of the velocity of objects carried in the storm came under the writer's notice in East St. Louis. The long approach to the Eads Bridge begins with a plate girder structure starting from an earth bank about 15 ft. above street level. About 50 ft. from the end of this girder a 2 in. × 8 in. white pine plank was hurled endwise against the south side of the girder with such velocity that it punched a hole in the web and remained sticking in the girder. The end of the plank, about 5 ft. long, is split lengthwise and projects about 4 in. through the girder and is somewhat bruised. The metal at the edges of the hole does not show much distortion.

Examples of the tremendous force exerted by the tornado could be multiplied without end and in time when all facts are collected and verified will add much interesting information to engineering literature. The writer has presented only such cases as have come under his personal notice.

JULIUS BAIER, C. E.

ST. LOUIS, May 31.

REPORT OF MR. FRANKENFIELD—U. S SIGNAL BUREAU.

For the past week the weather in the vicinity of St. Louis has been characterized by low barometric pressure, high temperatures, excessive humidity and prevailing southerly winds. The pressure also has been low throughout the West.

At the same time it has been relatively high in the South, causing the warm southerly winds to blow from the Gulf of Mexico laden with moisture. This moisture was held in suspense in the warm atmosphere and the humidity continued to increase from day to day. The mean temperature averaged from 3 deg. to 13 deg. above the normal each day, while the humidity ranged from 7 to 20 per cent. above the mean for this season of the year.

Wednesday morning the weather map showed low pressure still overlying the West, with its center of depression extending in an irregular oval from the Texas Panhandle northward through Western Kansas into Western Nebraska. Throughout the state of Missouri high temperatures and humidity prevailed, with southerly winds. The popular term "warm and muggy" will apply up to 4 p. m. The storm center moved slowly eastward during the day, and at 7 p. m. was central in Northwestern Illinois, bringing the state of Missouri in the southeast quadrant about 5 p. m., the usual seat of development of severe local storms. The barometer commenced to fall at noon, and by 3 p. m. had fallen 0 13. About this time the sky became thickly covered with cumulus-stratus clouds, but in reverse position, the rounder portions being underneath; by 3.30 p. m. these clouds had settled into a uniform mass of stratus clouds, which commenced to assume a light green color in the northwest.

The green-colored cloud continued to advance from the northwest, spreading more toward the west and north, and at the same time the temperature commenced to fall. The normal cyclonic circulation thus brought winds of unlike temperature and humidity into superposition, with the result that a decided instability of the atmosphere was produced and a violent secondary storm center was created, as indicated by the continued falling of the barometer. At 5 o'clock the barometer indicated a fall of .20 in. since noon, and the winds were becoming variable with a tendency toward the north. Thunder and lightening had commenced at 4:06 p. m., and rain in the form of large scattered drops at 4:13 p. m. At 5:04 p. m. the storm broke forth in all its fury.

The wind changed suddenly to northwest with rapidly increasing velocity - rain fell in torrents—the green clouds still remained in the west and north, but the storm moved from northwest toward southeast, and large, angry looking detached masses of cumulo-stratus clouds moved from almost every point of the compass, crossing each other with great rapidity. At 5:15 p. m. the wind reached a velocity of 80 miles per hour from the northwest, the greatest velocity ever reached in the history of the St. Louis station. From 5:20 to 5:30 p. m. the barometer fell 0.30 in., reading at the latter time 29.30 in.

It rose almost instantly 0.39 in to 29.74 in., and then continued in a series of irregular and decided oscillations until after 10 p. m. At 5 30 p. m. the wind had fallen to about 12 miles per hour, and shortly after changed direction to the southeast. The rain fell in torrents; from 5:04 p. m. to 7 p. m. 2 15 in. fell, and at 9:05, when it ceased, 3 04 in. in all had fallen.

From 5:04 to 6:04 p. m. 1.33 in. fell, and from 6:25 to 6:35 p. m. 0.64 in. fell.

The outer edge of the path of the storm through the city, as near as can be determined, was from northwest-west to southeast, curving in the extreme northwest portion of the city somewhat toward the east, so that a portion of the city, approximately west of Union avenue, experienced but little of its effects as far as the wind was concerned.

The storm then continued more in a southerly direction until the southern limits of the city were reached, when it turned more to the eastward and northeastward and moved across the river to East St. Louis.

The entire city within this boundary experienced the full effects of the storm. The direction of the wind was from northwest to northeast during the high wind, and remained so until 5:55 p. m., when it shifted to east southeast. The velocity decreased very rapidly after 5:25 p. m., so that during the second rainstorm it did not reach a velocity higher than 20 miles.

The electrical display during the storm was of exceeding brilliancy.

The whole west and northwest sky was an almost continual blaze of light, and the reflection could be seen beyond the clouds, extending far into the southern sky. Intensely vivid flashes of forked lightning were present, being vividly outlined in green, blue and bright yellow colors against the dull yellow background of the never-ceasing sheet lightning. This

display lasted as long as did the rain, but occasional flashes continued to be seen after 10 p. m. The thunder ceased at 9:50 p. m.

AS SEEN BY A RAILROAD OFFICER.

We have the following additional report from a railroad officer in St. Louis:

The railroads have suffered severely, there being 20 distinct lines into St. Louis and East St. Louis, besides the belt and terminal companies located therein. Some of the roads suffered but slight inconvenience, after removal of the débris and wreckage of buildings or a few cars; in other cases repairs will take time and cost much money.

In St. Louis comparatively little loss occurred north of the Eads Bridge (Terminal Railroad Association). This loss was confined to broken wires and poles, small-frame buildings, and ends and fire walls of brick ones. The Merchants' Bridge suffered no injuries. The C., B. & Q. (Keokuk Line), further north, had a landslide at Bissell's Cut, due to rain, calling for the use of a couple of steam shovels; in St. Louis it lost some of the roofing of its freight houses, as did the rest there, the Wabash Western and the Missouri, Kansas & Texas. The Terminal Railroad and the Missouri Pacific and the San Francisco companies, around Union Station and in their freight yards, suffered a good deal of inconvenience because of breakage of poles and wires, and a little damage to cars, but soon had trains moving on time. The Iron Mountain yards also had about the same experience.

On the east side it was more serious. North and south along the bank of the Mississippi are the yards of a dozen different systems, their extent being a little over two miles, and reaching back eastwardly an average distance of half a mile, increased, in the case of the great yards of the Terminal Association and the National Stock Yards Company, about thrice that distance. With its center a little south of the Eads Bridge, the storm swept across these yards, tearing down houses, overturning cars, and leaving but a mass of wreckage. Immediately north of the bridge, its tracks running east and west, lay the Vandalia freight house, about three blocks in length. Looked at from the bridge after the storm it would have been hard to believe that any structure had existed there. Freight cars could be seen, and kindling wood all about them, but no other evidence that a building had stood over them. At the western end, where the office had been, parts of the second story interior partitions were left, distorted and falling. From this building several bodies were taken. The Vandalia engine house, half a mile east of the freight house, was swept clear, leaving the engines in their stalls as in a yard.

Directly west of the Vandalia freight house, and on the banks of the river, stood the freight house of the East St. Louis Connecting road. This road is the Belt Road, owned by the Wiggins Ferry Company, and used for its car transfer service. The house was a newly built, substantial brick structure, but it was leveled and its contents scattered. Between it and the bridge lay an old ferryboat, undergoing process of dismantling. After the storm this boat was south of the bridge, having been blown out into the river, south and then east again and up so far on the levee as to throw the outer end under water. The Ferry Company, which does about one-quarter of the freight car transfer service at St. Louis, had every boat, both car transfer and ferry, except one, more or less injured, and suffered in its yards and tracks as did the railroads.

Further north were the Baltimore & Ohio Southwestern, the Chicago & Alton, Chicago, Burlington & Quincy, Wabash Eastern, and the Toledo, St. Louis & Kansas City, all losing cars and having poles, wires and buildings damaged, but not so severely as southward.

South of the bridge was the Louisville & Nashville freight house. The next was Big Four, the Cairo Short Line (now Ill. Central), and the Mobile & Ohio. All of these were more or less damaged, but the houses of the two first named were absolutely destroyed. Cars were overturned, goods from the platforms scattered, and chaos the rule. The central line of the storm seems to have passed across, or just south of, the east end of the Eads Bridge and its yards, the course of its approach and thence to its yard being approximately that of the course of the storm, i. e., on a northeast-southwesterly direction. In detail, the damage to the bridge and its property was as follows: [This is covered in Mr. Baier's report, and therefore is omitted here.—EDITOR.] The wreckage here was cleared away and trains moved Thursday afternoon. It was confidently expected that the upper floor would be ready for vehicles by Tuesday—when it could be made to carry the electric cars could not be so readily determined. The large interlocking tower and machine at the east end of the bridge were very badly damaged and may have to be entirely rebuilt.

Half a mile east and a little north of this was the Relay Depot. This suffered severely, the railroad Y. M. C. A. building next to it being entirely destroyed. South of it, in East St. Louis proper, there was most awful destruction of life and property. North and east, in the Terminal Co.'s yards and toward the National Stock Yards lay about two hundred derailed and broken cars. Some had been blown into the Cahokia Creek, others thrown north and south alternately along half a mile of track. In one case a heavy refrigerator car had been overturned on a northern track of the yard, where it was comparatively free from other cars, and had rolled over and over across 15 tracks, until there was but the floor left. The indentations could be all noted and its revolutions counted. Where the Yard Agent's office had stood there is no sign left. Near thereto stood one of the largest of the Terminal locomotives. The men took refuge about the engine. But the storm forced it sidewise, and the rails are turned so that the flanges of the wheels rest on the web of the south rail, which is torn from its place and bent considerably. Six wrecking engines and derricks were set to work and the tracks cleared as rapidly as possible, notice being sent out on Friday noon that the Terminal Association would receive freight.

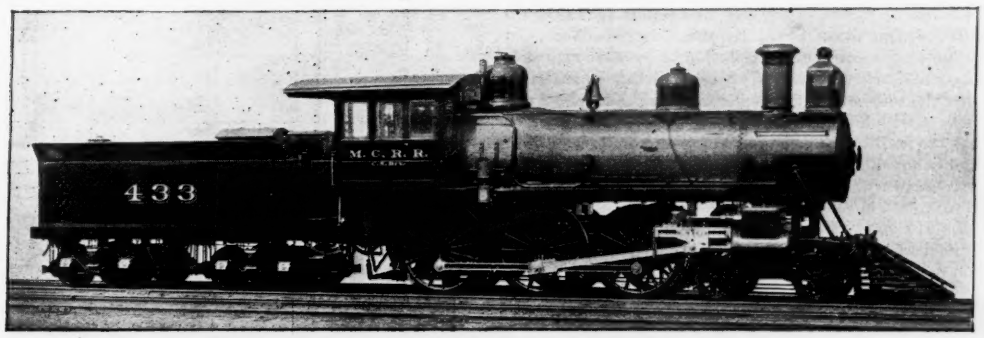
A pleasant feature of the situation has been the general proffer of assistance from lines which escaped with a lighter loss, and the President of the Terminal Association, Mr. Walsh, when he found that his company had suffered less than he feared, was not behind the others, for he wrote Mr. Scullin, President of the Wiggins Ferry Company, his very active competitor, tendering all that he could spare of the facilities of his company.

Superintendent Miller, of the Vandaila Line, is reported to have said that track was badly damaged by water for several miles out of East St. Louis. He reports 13 bodies taken out of the freight house in East St. Louis.

A passenger train of the Terminal road was overturned at Granite City, near the east end of the Merchants' Bridge. There were over 300 passengers (shopmen) but only one was killed, one seriously injured and about 40 slightly injured.

Fast Run on the Canada Southern.

A fast run was made over the Canada Division of the Michigan Central on May 7, with a special train of three cars, the distance from Windsor to Fort Erie, 229.4 miles, being traversed in 3 hours 34 minutes and 59 seconds, equal to 64.03 miles an hour. There was only one stop, that at St. Thomas, to change engines, 4 minutes 40 seconds. Superintendent Morford deems it proper to allow, besides this, 15 minutes for time lost at railroad crossings and in crossing the switches at the ends of double track, which would make the average speed from Windsor to Fort Erie 70.44 miles an hour. About two-thirds of the Canada Division is single track. The fast train over the Lake Shore & Michigan Southern on Oct. 24 last ran 181.5 miles, including stops, at 68.67 miles an hour; deducting stops, the rate was 69 67. The Lake Shore train ran 289.3 miles at 65.14 miles an hour, including stops, and at 66.68 deducting stops. In comparing this run with that of the Michigan Central, it is to be remembered that the Lake Shore road is double track all the way. The weight of the cars of the Michigan Central train was 115 tons and those of the Lake Shore train weighed 152¼ tons. The Michigan Central train was hauled by 10-wheel engines with 19 in. × 24 in. cylinders, and 68-in. driving wheels. These engines were built at Schenectady in 1889, and we show herewith an illustration of one of the same class. They carry a boiler pressure of 160 lbs. per sq. in. and the weight in working order is 123,500 lbs.; weight on drivers, 96,300 lbs.



Michigan Central Passenger Engine.

Built by the SCHENECTADY LOCOMOTIVE WORKS, *Schnectady, N. Y.*

Railroad Legislation in New York State.

The following bills affecting railroad interests were passed by the New York Legislature of 1896.

Bill No. 1,279 relates to unclaimed freight and baggage. Railroads may deliver any unclaimed freight or baggage which has been held sixty days to a warehouse and thereafter be rid of all liability. Two years is the time for which goods must be kept, but unclaimed live-stock and perishable freight or baggage may be sold without notice. All money received from the sale of unclaimed goods is to be turned over to the State of New York to be held in trust for the person entitled to receive the same.

No. 1,153 authorizes the appointment of a State Examiner of Railroads. The Board of Railroad Commissioners shall employ an expert accountant, who is familiar with railroad accounting, to make examinations of the books of such corporations as come under the jurisdiction of the board and to collect and compile railroad data; also to employ an inspector, who shall be a civil engineer and an experienced railroad man; also an inspector, who shall be a competent electrical engineer, to make inspections of roads and perform such work as the board shall require; also additional clerical force, engineers, accountants or other experts, either permanently or temporarily.

No. 740 makes it unlawful for any railroad corporation operating a steam railroad in the state of 50 miles in length, or more, to heat its passenger cars on other than than mixed trains, excepting dining-cars, by any stove or furnace either kept inside the car or suspended therefrom.

No. 415 requires every railroad over 100 miles long to issue mileage books containing coupons for 1,000 miles at not more than 2 cents a mile; also that the holder of a mileage book may obtain at any ticket office of the road issuing the book a mileage exchange ticket for coupons representing any number of miles which he or any member of his family or firm, or salesman of such firm, may desire to travel, and that this ticket shall be accepted without presentation of the mileage book on which the ticket was obtained; also that these tickets will entitle the holder to the same rights and privileges in respect to the transportation of person and property to which the highest class ticket issued by the company would entitle him. For refusing to check 150 lbs. baggage on a mileage book, there is a penalty of $50.

No. 588 provides that within one year from the passage of the act two-fifths of all cars in use on elevated railroads in New York City must be lighted by gas or electricity of not less than 18-candle power; an additional two-fifths to be so equipped with the succeeding two years and within three years all cars so operated must be lighted in that manner.

No. 90 is the well-known bicycle baggage bill. A check must be given provided there is place for suitably affixing the check. If such check is refused the corporation shall pay the passenger the sum of $10, and no fare shall be collected from him.

No. 547 provides that a street railroad or extensions thereof shall not be built or operated unless the written consent is obtained of the owners of one-half the property abutting on the line of the road or proposed road in cities and villages, and two-thirds of the property abutting in towns not within the corporate limits of a city or village. The value of property shall be determined by the assessment roll of the village, city or town in which the road is situated or proposed. The consent of the local authorities shall operate as the consent of any village, city or town as the owners of such property.

No. 989 provides that when a railroad shall be sold under a mortgage given in any other state, such railroad being partly in New York, such sale shall operate to pass title to the purchaser of that part of the road lying in this state with the same force and effect as if the judgment or decree had been made by a New York court.

No. 1,429 requires that all freight cars and locomotives shall be equipped with continuous power or air brakes immediately after the passage of this act, in addition to such freight cars or locomotives already so equipped, at least ten per cent. of all freight cars and locomotives operated in New York State shall be equipped each year until all cars and locomotives are so equipped.

No. 1,430 requires that all freight cars be equipped with automatic couplers, at least 20 per cent. being equipped each year.

No. 1,515 validates all consents of local authorities for the construction of street surface railroads in cities of the first and second class, given between Dec. 1, 1895, and Feb. 1, 1896, where a company has failed to get a certificate from the State Railroad Commission, authorizing it to build its road, or has not complied with Section 59 of the railroad law.

No. 898 amends the penal code so as to remove locomotives from the operation of the law, which says that all railroad cars and engines shall be equipped with automatic couplers.

Section 41 of the Raines Liquor-Tax law says that any person or officer of an association or corporation engaged in the business of conveying passengers or property for hire, who shall employ in the conduct of such business, as an engineer, fireman, conductor, switchtender, train despatcher, telegrapher, or in other like capacity, so that by his neglect of duty the safety and security of life, person or property so conveyed might be imperilled, any person who habitually indulges in the intemperate use of liquors, after notice that such person has been intoxi-

cated while in the active service of such person, association or corporation, shall be guilty of misdemeanor.

Among the bills that were before the Legislature this year, but which were not passed were the following: To abolish the railroad commission and establish a new commission to be elected by the people; to promote the abolition of highway grade crossing by provisions somewhat like those in force in Massachusetts and by appropriating one million dollars annually from the state treasury; to require vestibules on street cars for the protection of motormen; requiring heating and lighting of street cars; requiring fenders on street cars, and limiting street railroad fares to five cents for any journey over the lines of one company within the limits of a single city.

Kentucky Railroad Commissioners' Report.

The sixteenth annual report of the Railroad Commissioners of Kentucky, for the calender year 1895, signed by U. Woodson, C. B. Poyntz and J. N. Saunders, has been issued. The opening chapter contains facts and discussion concerning railroad matters in the United States as a whole. This is followed by general remarks on the railroads of Kentucky. Nine companies have been sold, reorganized or otherwise changed. Only 8 miles of new railroad was built during the year. The length of railroad in the state is 3,044 miles, and the valuation, for state taxation, was $52,171,046, which is a trifle less than the valuation for 1894. The state taxes paid in 1894 were $205,995; those for 1895 are not given. The foregoing sum does not include county and municipal taxes paid by the railroads. The report says that the most significant railroad event of the year was the opening of the Louisville and Jeffersonville bridge, admitting the Big Four to Louisville. This, with the passing of the control of the Kentucky and Indiana bridge to the Southern and the Baltimore & Ohio Southwestern roads "will smash the monopoly of freight handling in Louisville, so long enjoyed by the Louisville & Nashville." About 40 pages of the report are taken up with the complaints heard by the Commissioners. In closing they recommend legislation to require railroads to become corporations and citizens in the state; to require the railroads to define the boundaries of school districts in which they are taxed; to limit freight rates on coal; to facilitate adjustment of overcharges by allowing the consignee to recover double the amount of the overcharge with costs; to require the railroads to equip all cars with automatic couplers and continous brakes, and all locomotives with driving-wheel brakes; and to more clearly define the duty of the Railroad Commission in assessing interstate railroad bridges.

Six passengers, 42 employees and 53 other persons were killed during the year and 63 passengers, 891 employees and 160 other persons were injured.

The assessments of the railroads for taxation are given at length, filling 150 pages, and this is followed by 40 pages of matter, giving a condensed history of each railroad. The book contains the constitutional and statutory provisions regulating railroads in Kentucky and an abstract of the provisions of the railroad laws of all the states and territories. These state laws are indexed in a table designed to facilitate comparison of each law with the interstate commerce law.

The Reading Subway—Philadelphia.

At a conference held May 28, the officers of the Philadelphia & Reading Railroad and of the City of Philadelphia agreed upon certain modifications in the plans for the Pennsylvania avenue subway (described in the *Railroad Gazette* of May 22) and cleared up a number of points that have heretofore remained unsettled. The elaborate apparatus proposed for artificial ventilation of the tunnel is abandoned and the tunnel is to be 1,000 ft. shorter than was at first proposed. Seven openings will be made on the center line of the tunnel, each opening to have an area of 300 sq. ft. The cost of constructing a ventilating plant was estimated at $300,000, and it would require about $16,000 a year to maintain the plant. From the estimates made and the proposals received for constructing the work, it was evident that the $6,000,000 authorized to be expended, in which expense the city and company share equally, would be inadequate. It was necessary, therefore, to make a reduction, and this was done by doing away with the ventilating apparatus and by shortening of the tunnel about 500 ft. at each end, or as the engineers may decide.

The agreement signed by the Mayor and by President Harris provides that the city shall pay for the construction of the signals as designed, the power house, and the building for the electric lighting plant, but is not to pay for any of the electrical machinery. It will also put in the boiler plant. The additional cost of the operation of the proposed signals, the cost of the electric lighting of the tunnel and of the operation of the hydraulic lifts will be assumed by the Philadelphia & Reading. The city is not to be called upon to pay any of the cost of the maintenance of any part of the subway works.

On the south side of the subway east of Seventeenth street, a hydraulic lift is to be constructed capable of raising an engine and four cars; this is to give access to those manufacturers whose works are on the old street level. A track will be carried from the lift on this latter elevation across the subway to reach those manufacturers on the north side of Pennsylvania avenue.

This final agreement between the city and the railroad officers leaves the whole scheme in shape to be started at once, and it is understood that there will be no delay in putting the work under way. Under the ordinance the Director of Public Works will have charge of the work, and will appoint such engineers, draftsmen and inspectors, etc., as may be necessary.

As previously stated, proposals for the work to be done were received a few weeks ago, but so far no contracts have been awarded. The contracts for the tunnel section will be readvertised as soon as the revised plans are completed. The new bids will be opened about July 1, and the contracts for all the work will be awarded at that time.

Pooling Locomotives.

The practice of pooling locomotives did not find many friends at the recent discussion before the Western Railway Club.

Mr. BARR says that he is unhesitatingly and uncompromisingly opposed to it, and does not know of a single advantage to be gained from it. When engines are pooled there is no man on the road who considers himself responsible for the care and condition of the locomotive. He does not believe that any road has tried the experiment without increasing the cost for repairs, and possibly for fuel. It is his practice to assign men definitely and regularly to the locomotives, and when more work is required than the men can do, extra men relieve them, but the regular men are held responsible. He said, further, that in a rush of business he can get as high as 1,500 miles a week out of engines without pooling, and in passenger service considerably more than that. Mr. Mackenzie confirmed Mr. Barr's statement as to the mileage to be got out of freight engines without pooling.

MR. ATTERBURY, of the Pennsylvania Lines, agreed with Mr. Barr as to the general fact that the maintenance account for pooled engines was increased By the exercise of a little ingenuity freight engines can be double crewed; that is, three crews for two locomotives and five crews for three locomotives, etc., and thus the engines will make a larger average mileage than if they were pooled.

Mr. G. W. RHODES took a more moderate view of the question and thought that there were conditions under which more work can be got out of pooled engines.

MR. POITER, of the Pennsylvania Lines (President of the Club) fails to see where the cost for repairs will be much increased by pooling. There is some truth in the argument that fuel consumption would be increased. The question is dependent a good deal on conditions. On his road the conditions are such in freight service that the pooling system seems to be the only way to get the best results. On a long division of 280 miles, where engines run 149 miles one way and 131 the other, a man could not go directly back after a trip one way on a freight run, but most of the engines can go back as soon as the fires are cleaned. He thinks that on such a division he gets the best mileage, when business is hoavy, by the pooling system. The pooling system operated in small pools, where two men are assigned to one engine, or three men to two engines, etc., gives the best results.

Mr. QUAYLE, of the Chicago & Northwestern, was surprised at the figures given by Mr. Barr of 1,500 miles a week. On the Northwestern in busy times they can make 1,300 miles a week. Some engines in fast-freight service make about 2,000. His experience is that the cost for repairs is less on pooled engines than when regular engineers are assigned to regular engines, but the fuel account is greater in the pooling system.

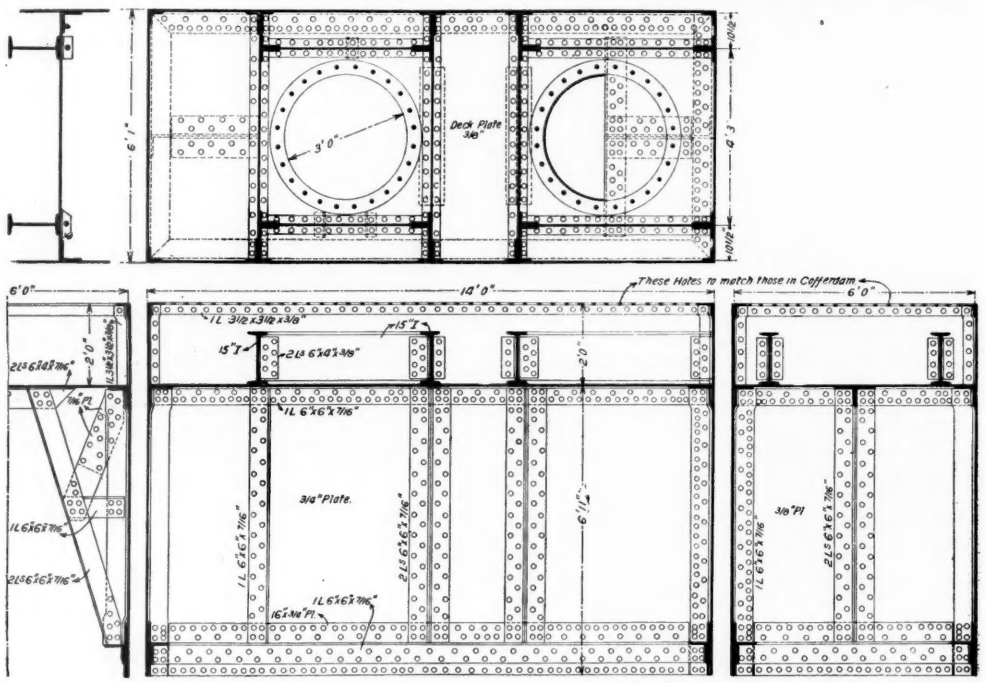
Mr. J. F. DEEMS thought that the question could not be disposed of by an off-hand discussion. If he were going to speak on the subject he should certainly speak in favor of pooling, but nobody has data or figures at hand and the question is too big for such desultory discussion. In this Mr. F. A. Delano agreed.

The Commercial Cable Building.

In sinking the foundations for the Commercial Cable Building, between Broad and New streets, New York unusual difficulty has been encountered. This building is to be 21 stories in height and it was decided to sink the foundations to bedrock by means of pneumatic caissons, which work is now being done. At the site of the building the rock lies from 50 ft. to 55 ft. below the pavement in New street. Above this is a layer of hard pan from 3 to 10 ft. thick, which is more than is usually found in the lower part of New York, and above the hard pan is the quicksand usually found in this neighborhood. It was feared that sinking the caissons would weaken adjacent foundations, which are not carried to bedrock, and it was therefore necessary to reinforce them. We will describe the method by which this was done after a brief description of the foundations themselves.

A general plan, elevation and cross-section of the foundations showing the arrangement of the caissons and grillages are given in the accompanying illustrations, and also the details of one of the caissons. It will be noticed that these are in two forms, it being advisable from the nature of the positions to have the side caissons rectangular, and the central ones circular in cross-section. Both are, however, similar in construction. The rectangular caissons vary in horizontal dimensions from 6 × 14 ft. to 9 × 18 ft. and are 9 ft. high. They are made of iron plates riveted together and strongly braced. Each has two air locks, one being used for taking out the excavated material and the other by the workmen.

As the caissons are sunk, sections of sheet iron cofferdams are riveted on above them. These are merely a continuation of the caisson proper, but are of a lighter construction. A distance of 5 in. is left between the ends of adjacent caissons to facilitate sinking, but after they are finally put down and the filling with the concrete begun, the ends of the coffer dams will be taken off and the concrete filling made continuous from the subcellar upward. The grillages of steel beams, which carry the columns of the building and are embedded in the concrete of each caisson, are made principally of 24-in. I-beams, fastened together and held in position by tie rods and cast-iron separators. In sinking through the quicksand the caissons in some cases were sunk about a foot an hour, but in the hard pan the rate was considerably less.



Details of Caisson, Commercial Cable Building.

At the ends fronting on Broad and New streets sheet piling will be driven to hard pan and backed with a concrete retaining wall. A water-tight wall is thus obtained on all sides, which is necessary, as it is desired to have two floors below the street level, making the subcellar floor 15 ft. below the natural water level.

The method adopted for strengthening the adjacent foundations consists of forcing down through the material immediately under the wall to be supported, metal columns, which are cleaned out and filled with concrete. In placing one of these columns the first step is to cut an opening in the wall 10 to 12 ft. above the ground and build into it two or more steel beams, 5 to 8 ft. long, laid horizontally. An opening 2 or 3 ft. wide is then cut from the under surface of the beams down through the foundation. A short section of column, usually 4 to 6 ft. long, is then placed vertically on the center of the opening and forced down by a hydraulic jack, which rests against the under surface of the horizontal beams. Additional sections are added until the foot of the column rests on the hard pan or rock, as the requirement may be.

The first wall to be supported was the one under No. 22 New street. This is a brick building four stories high and has a length of 62 ft. The foundation was originally on the natural earth, but the wall is now carried on nine columns, each consisting of a 10-in. gas pipe filled with

concrete. Each alternate pipe has an interior 8-in. pipe placed so as to break joints, the space between the two pipes grouted, and the interior pipe filled with concrete. On the top of the pipe, near the ground level, are laid two 12-in. T beams, about 5 ft. long, on which is built a column of brick work laid in Portland cement mortar and capped with granite. A space is left between the cap and the upper T beams for the insertion of steel folding wedges, which have a lift of ⅜ in. in 12 in. by means of which the load is transferred to the column without causing settlement of the building.

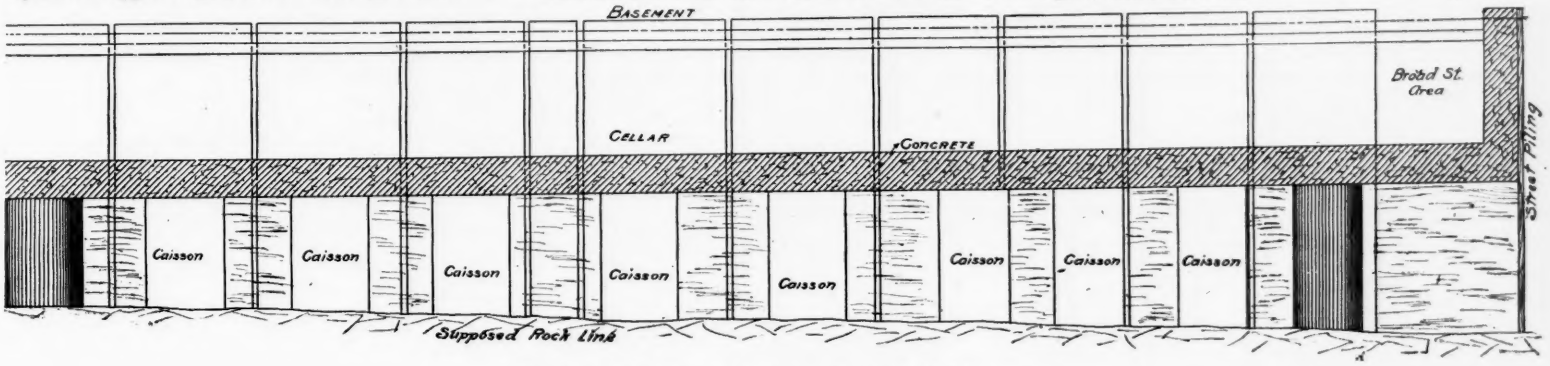
In forcing the columns down with the hydraulic jacks the interior is kept clear of sand to within 3 or 4 ft. of the bottom by a water jet, and when hard pan is reached a pressure approximately equal to the load to be imposed by the building is put upon it.

The next building to be supported was the Western Union Building, No. 16 Broad street. This is eight stories high above the street, and the wall to be supported is 78 ft. long. It rested on a pile foundation, the piles having an average penetration of about 17 ft. or about half way from the base of the wall to the hard pan.

On commencing to sink a caisson along this wall it was found that several of the piles projected under the caisson and had to be cut off, thereby weakening the original foundation considerably. For the support of this wall cast-iron cylinders were adopted. These are 30 in. diameter, 1 in. to 1⅛ in. thick and 4 ft. to 6 ft. long. They have interior flanges by which they are bolted together, and the ends of all sections are faced in a lathe. It has been necessary to draw a few of the piles at the side of each cylinder.

The cylinders are sunk to hard pan in the manner just described. An air lock is then put on, the water forced out, and the excavation continued under compressed air through the hard pan to bedrock, which is carefully leveled off. The cylinder is then forced down to a bearing on the rock and steel wedges inserted between the cutting edge of the cylinder and the rock wherever possible. The cylinder is then filled with concrete; a cast-iron cap 3 in. thick, is placed on the top of the cylinder; four heavy 15-in. beams 6½ ft. long, are laid across the cap in the line of the wall; four heavy beams are then cut of proper length to be inserted vertically between these beams and the corresponding set at the top of the opening, and wedged in; and finally the opening is bricked up, the vertical beams being embedded in the brickwork.

Mr. John Bogart is the Consulting Engineer for the Commercial Cable Company, Arthur McMullen & Company are the contractors for the foundations, and Mr. Alfred Noble is their engineer in charge of the work.



Elevation of Foundation of Commercial Cable Building.

The Present Status of the Compound Locomotive in France.—II.

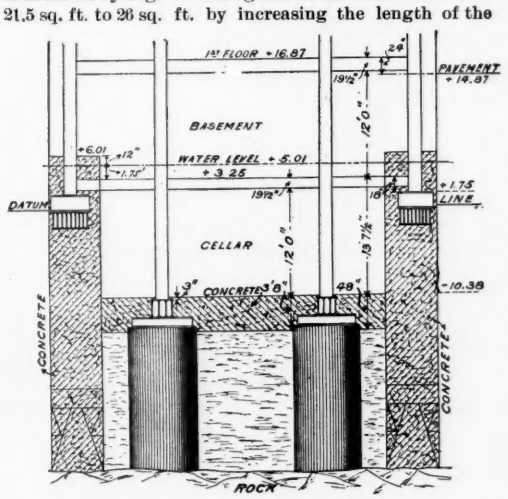
(*Continued from page 355.*)

THE SOUTHERN (MIDI) COMPANY.

It was at first the intention of the Southern Company to convert a certain number of their standard express ocomotives that had been used since 1877 into two-cylinder compounds, but the success attending the Northern locomotive, already described, influenced them to make a trial of this same type.

Two engines, Nos. 1701 and 1702, were, therefore, ordered and put into service in 1894, when they gave such good results that a second order for 12 engines was placed, which has now been delivered. These last machines only differ from the Northern type of locomotives by the introduction of the Serve tubes. The general and detail arrangements are the same, so that it is unnecessary to describe them.

Notwithstanding the satisfactory working of these engines, they were found to be too weak, since the trains on the Southern road are quite fast and very heavy. They, therefore, in 1895, ordered 24 locomotives from Creusot of the same type but more powerful, which is illustrated by Fig. 7. The grate area was raised from 21.5 sq. ft. to 26 sq. ft. by increasing the length of the firebox, which extends beyond the back axle, so that it was necessary to raise the center of the boiler; the average diameter of the shell is 4 ft. 5.15 in. instead of 4 ft. 1.78 in., and the diameters of the cylinders were raised from 13.78 in. to 21.65 in., the stroke remaining as before at 25.2 in. The diameter of the driving wheels was increased from 6 ft. 11 in. to 6 ft. 11⅛ in., and the total weight from 49 to 54.2 gross tons.



Elevation of Broad Street End.

The remainder of the principal dimensions of these engines will be found in the following table:

Grate area	26 sq. ft.
Length of firebox, outside	8 ft. 6.56 in.
Width " " "	4 ft. 5.54 in.
Mean diameter of shell	4 ft. 6.33 in.
Total length of boiler	26 ft. 5.2 in.
Number of tubes	111
Length of tubes between tube sheets	12 ft. 9.55 in.
Outside diameter of tubes	2.76 in.
Heating surface in firebox	121.4 sq. ft.
" " of tube	979.2 sq. ft.
" " total	1100.6 sq. ft.
Capacity of boiler: Water, 4¾ in. deep on crown-sheet	161.2 cu. ft.
Capacity of boiler: Steam	71.1 cu. ft.
Capacity of boiler: Total	132.3 cu. ft.
Diameter of H. P. cylinders	13.78 in.
" " L. P. "	21.65 in.
Stroke of pistons	25.2 in.
Steam pressure	192.5 lbs. per sq. in.
Distance center to center of H. P. cylinders	7 ft. 1 in.
" " " " L. P. "	1 ft. 11.23 in.
Length of H. P. connecting rod	9 ft. 8.15 in.
" " L. P. " "	7 ft. 10.5 in.
Diameter of driving-wheels	6 ft. 11.86 in.
" " truck "	3 ft. 5 in.
Possible lateral displacement of truck	1.97 in.
Total wheel base	24 ft. 7.28 in.
Distance between insides of frames	3 ft. 8.88 in.
Height of buffers above rails	3 ft. 6.7 in.
Center to center of buffers	5 ft. 8 in.
Total length of engine over buffers	33 ft. 10.9 in.
Width of foot plate	9 ft. 5.4 in.
Height of stack above rail	13 ft. 10.54 in.
Tractive power	11,220 lbs.
Weight of engine, empty	107,800 lbs.
" " " in working order	119,240 lbs.

When these locomotives are received the Southern Company will own 38 express locomotives built of the four-cylinder compound type.

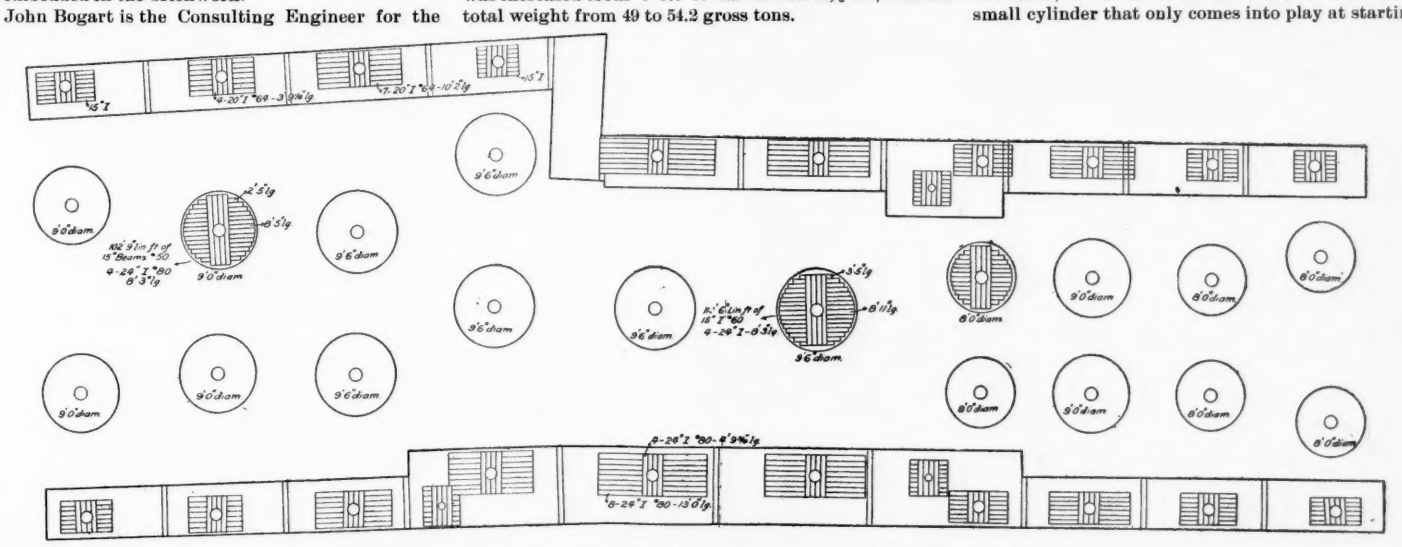
THE EASTERN RAILROAD COMPANY.

In 1893 the Eastern Railroad built two compound locomotives, having six wheels coupled, from the designs of M. Edward Sauvage. They were intended for fast freight service. These engines, which are very powerful and very simple, present a very fine appearance. Fig. 8 gives the arrangement of the cylinders, assembled and in detail.

We have said that the principal difficulty encountered in the construction of two-cylinder compound locomotives consisted in the designing of a single low-pressure cylinder having a diameter of more than 31.5 in., which, when placed outside the frames encroaches upon the clearance spaces. When the frames are inside the wheels it has been impossible to locate the cylinders between them for want of sufficient space. But this is just what has been done on the Eastern Railway engine, to which cylinders have been given, having diameters of 20.87 in. and 33.46 in. respectively, with a stroke of 25.59 in.

This locomotive has six wheels coupled, two of whose axles are placed beneath the barrel of the boiler, while the third is under the firebox, which has an external length of 8 ft. 10.3 in. The barrel has a diameter of 4 ft. 7⅛ in.

The steam chests are upon the sides and inclined; the exhaust from the high-pressure cylinder is led into the steam chest of the low-pressure cylinder by a pipe that makes a turn around the inside of the smokebox after having passed through a space containing a special starting valve. A safety valve limits the pressure in this pipe, which forms the receiver, to 71 lbs. per square inch. The exhaust takes place normally from the large cylinder alone, but there is an auxiliary exhaust from the small cylinder that only comes into play at starting.



Plan of Foundation, Showing Caissons and Grillages.

The starting apparatus includes three distinct parts—a throttle valve admitting live steam directly into the receiver, a clapet valve cutting off the small cylinder from the receiver, and an outlet into the atmosphere for the exhaust from the high-pressure cylinder. The throttle valve used for this auxiliary admission takes steam from the steam chest and not from the boiler direct, in order to avoid all danger of sudden starting in case it should be left open while the locomotive is standing.

When starting, the valve giving live steam to the receiver, as well as the direct exhaust pipe of the high-pressure cylinder, is open, and the clapet valve, separating the one from the other, is closed. In order to

change into a compound, the single controlling mechanism begins by closing the valve admitting live steam into the receiver, then the direct exhaust valve, and finally opens the clapet between the high-pressure cylinder and the receiver.

This engine was designed with the end in view of operating normally with a coefficient of admission for the two cylinders of from 45 to 50 per cent., while the actual power exerted is to be regulated by the throttle.

These are the only compound locomotives owned by the Eastern Railroad Company.

PARIS, LYONS & MEDITERRANEAN RAILROAD COMPANY.

The Paris, Lyons & Mediterranean Railroad Company owns a larger number of compound locomotives than any other railroad in France and uses them for express and fast-freight service. In the early part of 1889 this company put three models of compound locomotives into service on trial. At that time these designs were new,

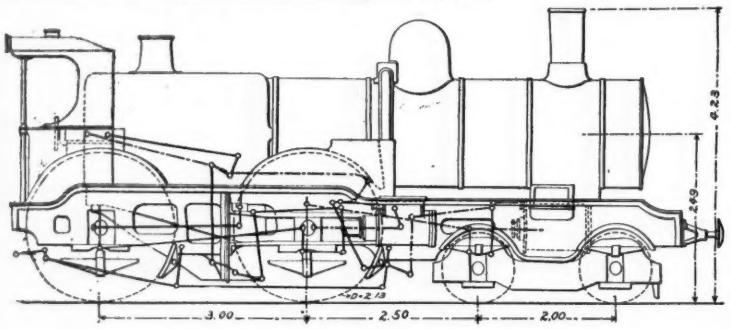


Fig. 7.—Compound Express Locomotive—Southern Railroad of France.

being of the eight-wheeled type, and they have served as the prototypes of those since ordered, namely:

A class for passenger and fast-express service; a class for freight service on lines of easy profile and heavy traffic; a class for passenger and freight service on lines with heavy grades.

These three classes, designed under the supervision of M. Henry, who was, at that time, chief engineer of the company, have the following characteristics:

1. The elevation of the steam pressure to 215 lbs. per sq. in. and the use of steel sheets.

2. The admission of live steam into the two inside cylinders whose pistons drive one of the two center axles.

3. The expansion of the steam in the two outside cylinders whose pistons drive the other central axle.

4. The coupling of these two axles together.

5. Reversing by a single mechanism with a steam counterweight, controlling all four of the valve motions at the same time and maintaining between them, for each notch in the quadrant, a ratio quite out of the control of the engineer, it being one that was rationally worked out in advance.

6. A possible admission of live steam into the receiver between the large and small cylinders, but for starting only.

7. The steam passes from the small to the large cylinders by pipes running through the upper portion of the smokebox, in which it is slightly superheated. These pipes form a receiver common to the two sides and have a capacity 3⅛ times the volume swept through by one of the small pistons in a stroke.

Each of these three classes corresponds to an old non-compound model from which it differs principally in the higher steam pressure in the boiler and the arrangement of the cylinders. The fast express class, shown in Fig. 9, is typified by the *C* 1 and *C* 2 locomotives, which have four wheels coupled, the diameters being 6 ft. 6.75 in., and four truck wheels with a diameter of 4 ft. 3.18 in., two being in front and two at the back. These engines were designed to haul express trains running at from 43.8 to 56.2 miles per hour and occasionally rising to 69 miles. The low-pressure cylinders have the same diameter as those of the old simple locomotives—19.68 in. with a stroke of 24.4 in.; the high-pressure cylinders have the same stroke with a diameter of 12.2 in.

The second class is represented by engines 3,201 and 3,202 (Fig. 10) and was intended for hauling through freight trains between Paris and Lyons, or passenger and mixed trains upon lines whose grades occasionally exceed 2 per cent. Their normal speed runs from 15½ to 28 miles per hour. This locomotive is carried on eight wheels, all of which are coupled, and having a diameter of 4 ft. 11 in. The cylinders have diameters of 15.75 in. and 21.26 in., respectively, and a common stroke of 25.59 in., so that the ratio existing between the volumes of the cylinders is practically as two to five.

The third class of engines (Fig. 11), Nos. 4,301 and 4,302, has eight wheels coupled, the diameters of the same being 4 ft. 1¾ in., and the journals of the two end axles have a lateral play in their boxes of .98 in. The diameters of the cylinders are 14.17 in. and 21.26 in. respectively with a common stroke of 25.59 in. giving a ratio of cylinder volumes of 0.445 to 1. These locomotives should develop their full power at a speed of from 9 to 18 miles per hour, and were intended for passenger and freight service on lines having heavy grades.

The Walschaert valve gear is used on all three classes, except on the express engines; the eccentric has been dispensed with for driving the valves of the inside cylinders and a link controlled by a parallelogram oscillating with the connecting rod used in its place. The valves are of the Allen type with a steam passage. In order that the pressure in the high-pressure cylinders at the end of compression may not exceed that in the boiler, the clearance space is increased in volume.

Each of the low-pressure cylinders is provided with a relief valve, so that there may be no danger of its drawing ashes or cinders from the smokebox while running with the throttle closed. In order to make sure of starting there is a special valve provided, by means of which the engineer can admit live steam into the receiver. A safety valve mounted upon this receiver prevents the pressure from rising above 85 lbs. per sq. in. Starting is further facilitated by the use of side rods, which are considered to be indispensable in order to preserve the invariability of the relative position of angularity of the two groups of cranks, permitting the moments of motion at starting and while running to be regulated and the disturbances due to inertia diminished.

One of the principal peculiarities of these machines consists in the special reversing apparatus (Figs. 12 to 15) that has been adopted. It is characterized by the use of two cams *C* and *C*¹, mounted upon the same horizontal shaft *AB*, which controls the two reach-rods *D* and *D*¹ leading to the links. The outlines of these cams is such that the desired ratio between the points of cut-off of the two valves is maintained. A pinion is keyed upon the cam shaft that meshes in with an endless screw *E* that is turned by the engineer. Further, the

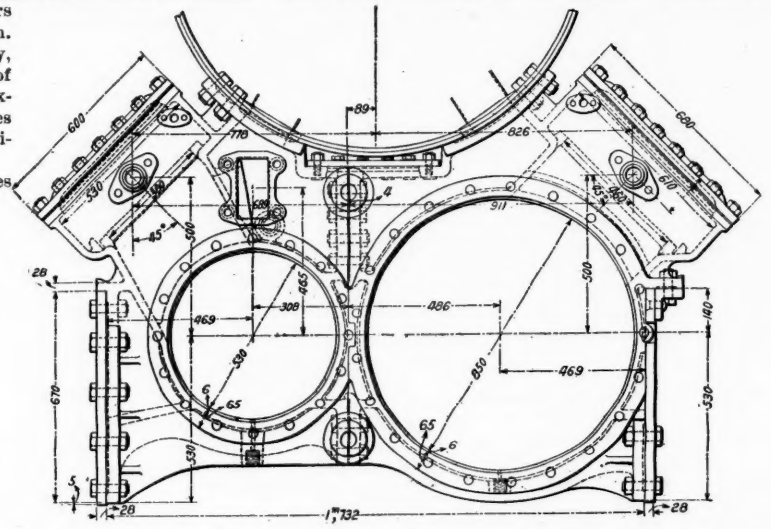


Fig. 8.—Arrangement of Cylinders on Compound Locomotive—Eastern Railroad of France.

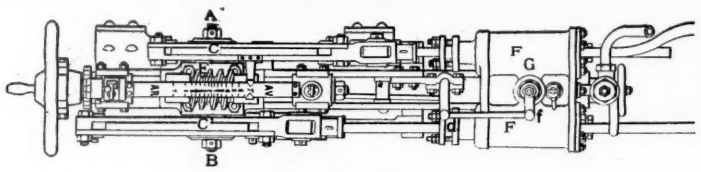


Fig. 13.

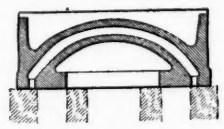


Fig. 15.

frame which is placed between each cam and the corresponding reach-rod has keyed to it the piston rod of a steam counter weight like that which has been used on the express engines of the company since 1880. The engineer's hand wheel, which is loose upon its shaft and forms a nut upon its threaded portion, can be more nearly parallel to the shaft for a certain distance and thus operate a distributing valve by which steam is admitted to that side of the piston where its action may be needed.

The cams are locked by the bolt *H*, which the engineer operates by means of a thumb spring, and which engages in the teeth of a pinion carried on the same shaft with the endless screw. The frames are locked by means of two oil cylinders *J*, in each of which there is a movable piston attached to one of the reach-rods and to a valve by which communication between the two ends of the cylinder can be opened or closed. This valve works automatically each time that the distributing valve of the steam counterweight opens or closes. A single distributing valve answers for the two auxiliary steam cylinders and a single butterfly valve for locking the two oil cylinders.

These three specimens of locomotives were built for trial only, and were intended by the company to establish the value of the compound system in a general way, and to determine the particular arrangements that should be adopted. The results obtained in service have been so satisfactory that the company has felt justified in developing the system, by introducing such modifications as may have been suggested by practice, either in the general arrangement of the engines or that of the details.

(TO BE CONTINUED.)

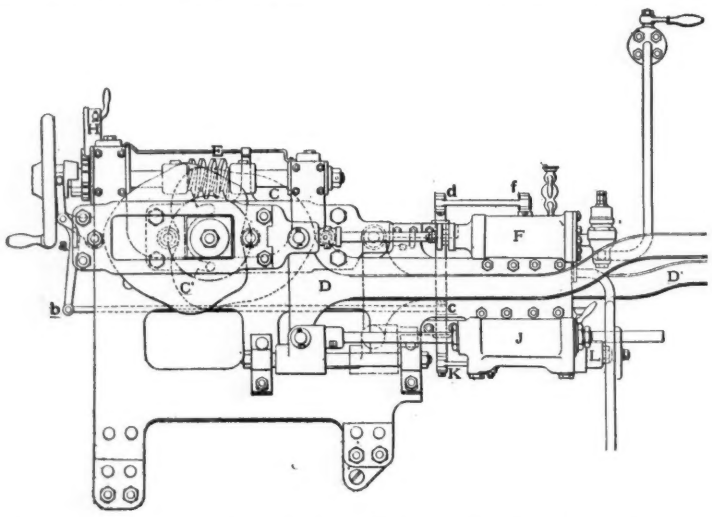


Fig. 12.—Steam Reversing Gear for Compound Locomotives—Paris, Lyons & Mediterranean Railroad.

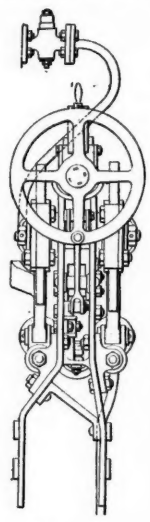


Fig. 14.

Another Bridge "Accident" on an Electric Railroad.

At two o'clock in the afternoon of May 26, a span of a bridge fell under an electric car in Victoria, B. C. At latest accounts 53 dead bodies had been recovered and three other persons were known to be missing, and there were said to be still other dead in the gorge. The car was one of those of the Consolidated Railway Company of Victoria, and 80 persons are said to have been on board. They were pleasure seekers going to see a sham battle in celebration of the Queen's birthday.

The height of the bridge above the bottom of the gorge is said to have been 75 ft. It is a highway, combination bridge, the tension members of iron; the floor beams are of wood. The substructure is iron cylinders and concrete piers. The bridge has four spans. The center spans are through, each 150 ft. long. The end spans are each 120 ft.; these are deck spans. The street-car track is on one side of the bridge. The entire eastern through span fell. The load at the time of the accident was about 19 tons. The cause of the failure of the bridge had not been ascertained at the time of our latest information.

The local newspapers say that the bridge had been surveyed and condemned three different times. It was built for wagon traffic and the car under which it fell had not been used recently on that line because it was a particularly heavy one, and it had been thought un-

safe to run it over the bridge. The bridge was under the control of the city, and heavy damage suits will be brought against the city. All the city bridges were at once closed until they could be inspected.

Foreign Railroad Notes.

An Englishman, Mr. H. T. Procter, has devised an apparatus, briefly described in the London *Railway News*, for adjusting the amount of gas light in a railroad car to the number of passengers occupying it. When a compartment is empty, a valve shuts off the gas, so that the flame burns very low, and when a passenger enters and sits down the valve is opened by an apparatus placed between the cushions and the fixed seat. To show the need for his invention Mr. Proctor has gathered, and presents in tabluar form, statistics showing what a large proportion of the compartments in English passenger trains are run empty. He presents figures for a number of the principal railroads, a large number of trains having been counted on each. The average percentage of empty compartments varies from 30 to 77½ per cent. The latter figure appears against the Metropolitan Line for three hours, between 6 a. m. and 9 a. m., on a certain day.

After July 1 the English railroads will carry drummers home to stay over Sunday at half rates. The tickets, at a single fare for the round trip, either first, second or third class, will be good from Friday to Monday, and will be sold to any station over 30 miles distant from the starting point. To guard against fraud the roads will require applicants to be members of the Commercial Travelers' Association, and a certificate bearing the photograph of the applicant must be presented.

The Vienna Locomotive Works at Florisdorf completed its 1,000th locomotive recently, and this engine is the first for the Vienna City Railroad.

The Pilatus Railroad, so far the highest of mountain railroads, carried 40,841 passengers last season, which is the maximum in its history. The gross earnings were $51,840 ($1.20 per passenger), and the net, $33,060. This made it possible to pay a dividend of 6 per cent. The profit from the hotel at the summit, which is part of the enterprise, was $7,200. One of the Rigi roads, which finished its twenty-fifth season last year, paid 8 per cent. and credited to a reserve fund a sum equal to 3.2 per cent.

The mileage of railroads of "general interest" in France was increased 55 miles in 1895, making the total at the close of the year 22,711 miles, of which 20,050 miles belonged to the six great companies, and 1,634 miles to the state system. Besides these lines of "general interest" there were 2,404 miles of "local" railroad in operation at the close of 1895; 88 miles have been opened during the year. The length of street railroads at the close of the year was 1,347 miles, no less than 196 miles having been completed during the year.

The German Society of Mechanical Engineers offers a prize of 1,200 marks ($288) for the best plan of a grain elevator to be erected at a certain place in Berlin, the design to cover motive power, machinery, lighting apparatus and other accessories.

The heaviest train movement reported on a German railroad is on the Main & Neckar line, which had in a recent year an average of 18.1 passenger trains and 6.8 freight trains daily over its 60 miles of road. This last statement of its length shows how deceptive such state-ments may be. In Germany, as here, the reports are usually for systems of lines, including some with thin traffic. The heaviest passenger train service of the lines of any directory of the Prussian State Railroads was 8.6 each way daily, on the lines of the Magdeburg Directory (1,120 miles), where the freight trains average 5.1 each way daily. The heaviest freight train movement was at the rate of 8.1 each way daily on the lines east of the Rhine worked by one of the two Cologne directories (1,468 miles), on which also was a passenger train movement of 7.1 daily. These may be contrasted with the 2.7 passenger trains and the 3.7 freight trains each way daily on the Hungarian State Railroads.

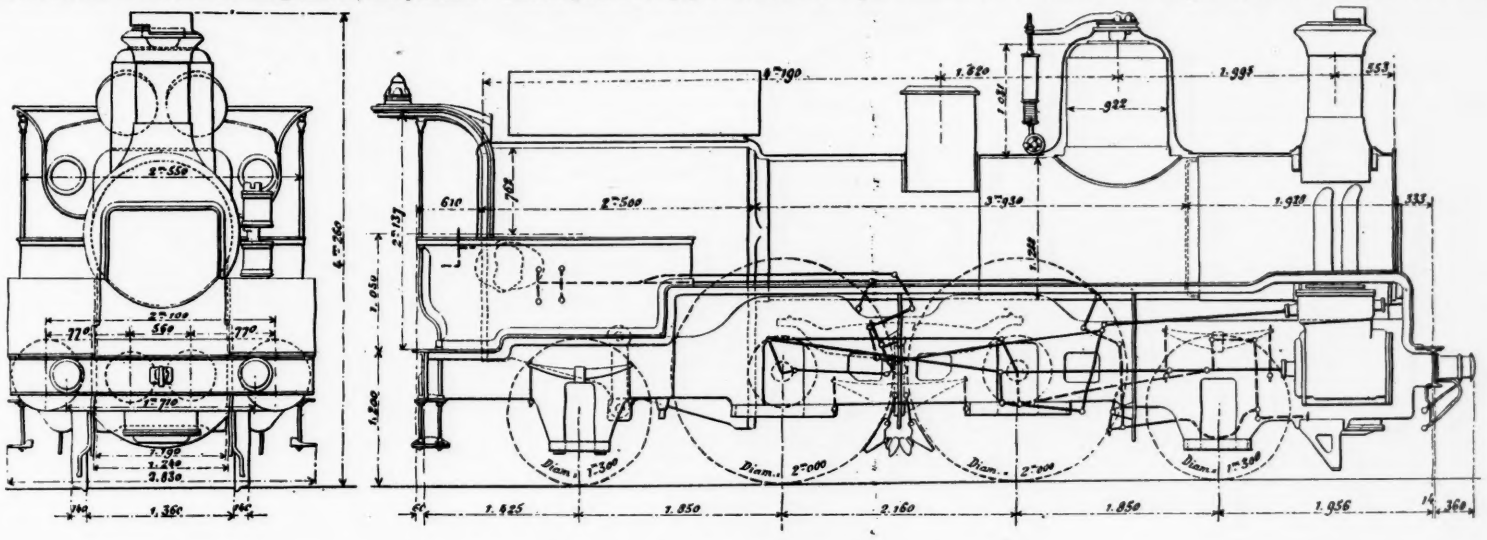


Fig. 9.—Fast Express Locomotive—Paris, Lyons & Mediterranean Railroad.

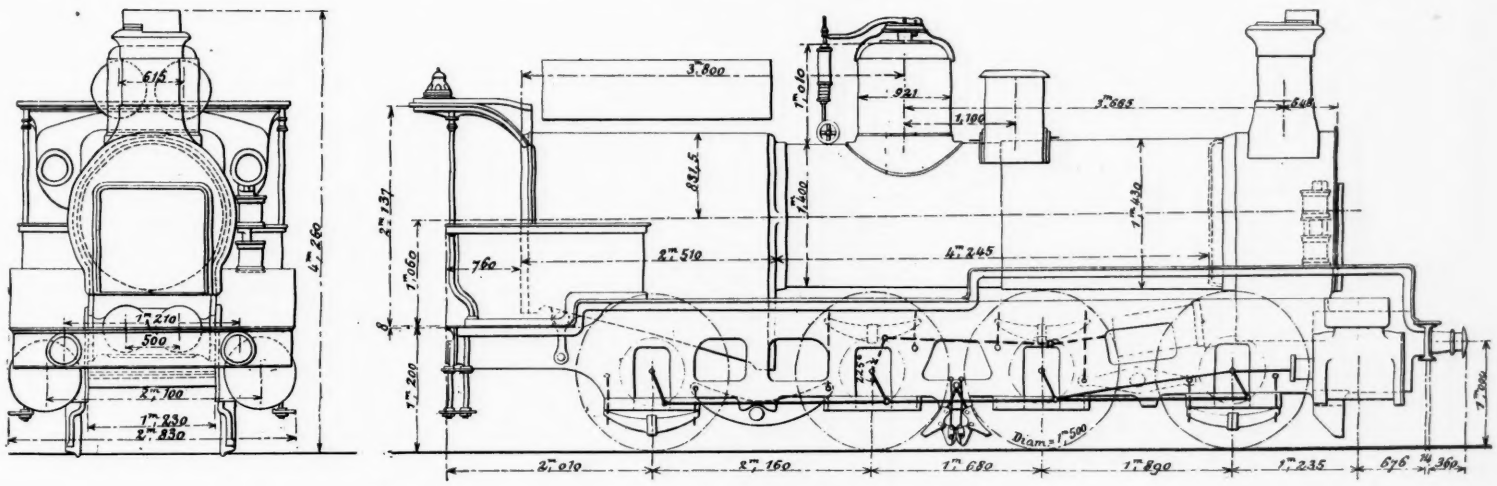


Fig. 10.—Heavy Compound Freight Locomotive—Paris, Lyons & Mediterranean Railroad.

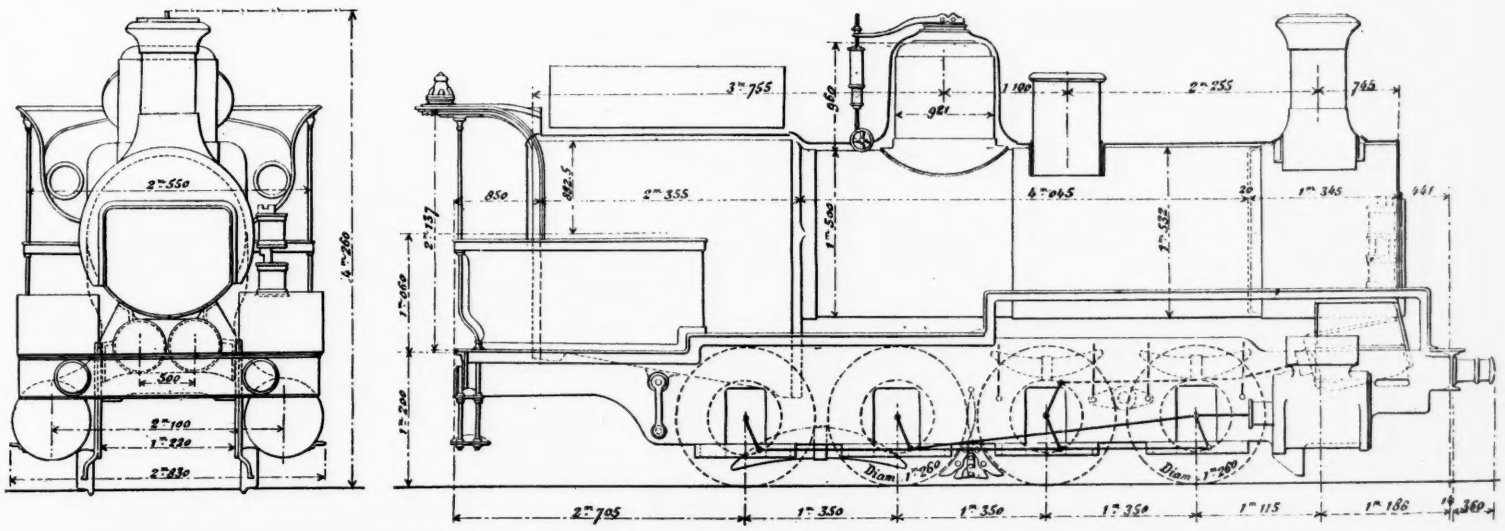


Fig. 11.—Freight and Passenger Locomotive—Paris, Lyons & Mediterranean Railroad.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The managers of the Joint Traffic Association have declined to approve a cheap excursion from Cleveland to Niagara Falls, at about 7 mills per passenger per mile, one from Fort Wayne over the New York, Chicago & St. Louis at a little higher rate, and one other; and the people are mad about it. A Cleveland paper says that "that big railroad trust known as the Joint Traffic Association has decided that the people of Ohio and Indiana shall take no more cheap excursions to Niagara Falls. . . . It is an outrage. Hereafter people will have to go by boat or pay what the Association demands." The only reason mentioned is that scalpers get hold of the tickets. Whether this is one of the real reasons we do not know, but in view of the fact that the passenger business as a whole does not pay its share of the interest on the cost of railroads—passengers being granted low rates and costly conveniences that have to be partly paid for out of the profit on freight—we surmise that one reason for the action of the Managers is their feeling that the roads can make just as much money at a little higher rate. There is no intimation that a rate of, say, one cent a mile would not be approved. The Cleveland people need not fear any very serious oppression as long as Lake Erie does not dry up. If big excursions at very low rates had any effect in making people willing to pay reasonable rates for transient rides, there would be more satisfaction in running them; but the Ohio Legislature will probably vote to reduce all fares in the State with just the same alacrity whether the railroads take people to the Falls for nothing every summer or not. Of one thing we are quite certain, and that is that excursion rates should never be made so low as to overtax the facilities of the road or to overwork the trainmen. Hundreds of big trains are run and get through all right, but everyone knows that the chances of accident are generally much greater with extra trains. No big accident has occurred to an excursion train in this country since 1893, but the danger has not been entirely abolished. Only this week we have noticed two collisions, on prominent lines, of special trains carrying officers of the road.

The compressed air motor for street service is attracting new interest and is evidently going to have a chance for fair and valuable tests, and many people are inquiring where it will find its particular field of usefulness. We recently described the purpose of the Eckington Street Railroad in Washington to put in 10 motor cars to be built by Messrs. H. K. Porter & Co. Last week we described the motor of the General Compressed Air Company, built at the Rome Locomotive Works. Still another air motor is pretty sure to be tried soon in New York City. At the first glance it is apparent that the compressed air motor car has a good many of the elements of a locomotive. It has a locomotive frame, the weight of the apparatus is carried on locomotive springs supported on pedestals, which in turn rest on axle boxes inside of the wheels to make room for the connecting rod on the outside of them. The wheels are counterweighted. There are cylinders, reciprocating motion, eccentrics, Stephenson link gear and a number of valves. The man at the throttle is a cross between a motorman and a locomotive engineer. He is the former, inasmuch as he only handles levers and need not be much versed in the machinery, and does not have to look for signals. He is the latter, inasmuch as he handles several levers: the throttle lever, the starting, running and braking lever, the link gear lever and in one construction a fourth lever, and he must of course exercise his judgment when to use them and in what combination and must be trained for such exercise of judgment. Apparently, air locomotive would be an appropriate name for the new arrival, or rather air dummy, since a car body is placed over the locomotive on a separate set of elliptic springs. It differs from a steam dummy in that its use for short distance travel only, permits separating the power generating apparatus from the dummy and the substitution of stored energy, the power generation being concentrated in a stationary plant for all the cars. The complication of the machinery on the motor and the difficulty of protecting it against dust and dirt would, we should suppose, banish it from the ordinary highway or macadamized turnpike and limit it to use on stone or asphalt paved, well kept streets, on elevated structures or on stone ballasted tracks on private right of way; and in congested streets it may be doubtful wisdom to expose so costly and highly charged a piece of machinery to the danger of collision with street vehicles. If we are right then, the field for air motors is a limited one, even that is hotly contested, and it may safely be said that in the battle for survival they have a hard struggle ahead of them.

Car Coupler Litigation.

Last January the Gould Coupler Company secured a preliminary injunction against the Trojan Car Coupler Company. The injunction was granted by Judge Coxe, in the United States Circuit Court of the Northern District of New York. The matter was appealed and Judge Lacombe, sitting in the United States Circuit Court of Appeals, of the Second Circuit, last week rendered a decision reversing the order of the Circuit Court, with costs of the appeal. This litigation is so interesting and important that it seems well to sum up the story briefly.

The various decisions granting injunctions to the Gould Company were published as a supplement to our issue of February 28. The first was a suit brought by the Gould Company against Pratt & Letchworth. This was tried before Judge Coxe in the United States Circuit Court of the Northern District of New York, and the decision was rendered Nov. 19, 1895, in favor of Gould. Judge Coxe granted an injunction and an accounting. The Gould Company brought suit for infringement of two patents, the Browning patent of 1882 and the Barnes patent of 1886. The Pooley coupler (made by Pratt & Letchworth) was held not to infringe the Barnes patent, but Judge Coxe held that it did infringe the Browning patent.

The essential point in the Browning claim (the point on which the case turned) was this: "For automatically opening and retaining said hook in proper position for coupling." In order to infringe, a coupler must have the means of performing both these functions automatically, and these means must be something more than mere inertia or friction of the parts caused by rust or otherwise. It was held that to infringe the device must do *both* of these things.

In the Pooley patent, owned by Pratt & Letchworth, which was brought into court as the infringing device, according to the Judge, "the hooks are thrown out by an ingenious double-acting lever contrivance patented to Charles A. Pooley, which is clearly an equivalent for the means described in the Browning patent." Browning did not specifically claim a lever; he did claim a flat spring pushing against the shank of the knuckle or an inclined plane down which the knuckle would slide as it rotated to open. But Judge Coxe held that Browning is entitled to a wide range of equivalents; that levers and springs are often used interchangeably and "whether it is pulled out by a coiled spring, pushed out by a flat spring, forced out by a lever, or made to slide down the spiral inclines of a hinge would seem quite immaterial."

The defendants in this suit insisted that their knuckle while automatically held open is not retained in a suitable position for coupling. But the Judge said that even "if the defendants are right, it is still true that it will couple with an opposing hook which is opened for a very short distance"; and "the partly opened position is not so desirable as the position which Browning had in mind, but it is a distinct advantage over a hook with no retaining device at all."

A motion for rehearing was introduced. This, the Judge denied and in considering this motion he spoke further, considering the term "automatic." He held that the Court is not called upon to give a definition of the term, because it is perfectly plain what Browning meant by it. He meant some device which would throw out the hook, as distinguished from the old method of going between the cars and pulling it out by hand—some method such as he described, connected with the coupling hook itself and illustrated by him in his patent by the incline and the spring, or equivalent mechanism. It will be observed that the Court gave a very broad and somewhat vague meaning to the word "automatic" in this case. Several experts have considered that this interpretation would cover even a chain fastened to the nose of the knuckle.

The Gould Company next brought suit in the same court for a preliminary injunction against the Trojan Car Coupler Company. The decision in this case was rendered Jan. 14, also by Judge Coxe, and the injunction was granted—this injunction to apply to new business, not to apply on orders or contracts already taken or existing, and, further, not to apply to car couplers now made and on hand in the defendant's possession.

The Trojan opening device is a rod reaching to the side of the car, which unlocks the knuckle by a turn. On the inner end of this rod is a finger, and when the rod is pushed in, the knuckle is opened. In this case Judge Coxe said: "I do not understand that there is any dispute that the Trojan coupler contains a retaining device," and he held further that it is clear that the finger attached to the lever rod in the Trojan coupler must be regarded as an infringement of the Browning claim for an opening device, for he holds the Browning claim to cover any mechanism inherent in the coupler head whereby the hook is pushed out or pulled out.

On the 11th of last February, the Gould Company secured in the United States Court, for the District of New Jersey, an injunction against the Smillie Coupler & Manufacturing Company. This also was on the ground of infringement by the Smillie apparatus of the Browning claim for a device for automatically opening the knuckle, and holding it open.

Now comes the decision in the United States Circuit Court of Appeals, which was rendered May 27. Judge Lacombe describes briefly the action of unlocking and opening the knuckle in the Trojan coupler; that is, when the rod is revolved, it raises the detent, but the raising of the detent does not set in motion any of the remaining mechanism. The rod must then be pushed in, and the finger pushing against the inner end of the knuckle causes the knuckle to swing open. The Judge says: "It is difficult to say upon what theory it can be contended that there is an exhibition of automatic action when a man of his own volition pushes a door open with a rod, and no exhibion of automatic action when the same man of his own volition pulls the door open with a hook." In the case in point, if the operator goes away after revolving the rod and unlocking the knuckle the mechanism does not open the hook at all; it is only opened because of a separate act of volition on the part of the operator. Therefore, if we give to the word "automatic" its ordinary and general meaning, the defendant's device does not infringe. In the Browning patent, the mechanisms described become operative as soon as the detent is unlocked, with no further act of a trainman, and they remain operative so long as the detent is unlocked.

This, then, is the point on which the decision in the Court of Appeals turned. In the opinion of the Judge, an opening mechanism, to be automatic within the proper definition of the word, must work and continue to work without human interference after the knuckle is unlocked. This point is stated in two or three different ways in Judge Lacombe's decision, but it comes down to this, that the Browning claim covers mechanisms which begin to act automatically without further human effort, when the knuckle is unlocked and continue so to act; while the Trojan mechanism requires one effort of the human will to unlock the knuckle, then another entirely distinct effort to throw the knuckle open, and then does not hold the knuckle open against displacement by jarring of the cars or other accident. When coupling is to be performed the trainman must still look to see if the hook is in its proper position, and if it is not, there is no mechanism which will take his place and do what is required. He must then again push the knuckle open; but the Court says: "This certainly is not an automatic opening within any ordinary meaning of that phrase and, as it seems to us, not within any unusual meaning which the state of the art or the language of specification will warrant reading into the claim."

We are not all surprised at this outcome of the appeal, for from the first it has seemed to us that Judge Coxe's definition of automatic was too loose to stand.

Judge Wheeler's Decision.

The decision of Judge Wheeler upholding the legality of the Joint Traffic Association, printed on another page, is so brief and so sweeping that the case will no doubt be re-tried in some form or other. The strength of the points on which the Government may depend for appealing to the higher courts we do not know, but if an appeal is not likely to prove satisfactory the Association can readily be attacked by some other kind of a suit, and perhaps in another district. In fact this much is hinted by the reporters who have interviewed the Interstate Commerce Commissioners at Washington.

Meanwhile the present decision is all that the railroads could wish. Judge Wheeler gives full weight and credence to the clause directing the managers to distribute traffic only "so far as may legally be done," and therefore holds that the agreement does not violate the anti-trust law; and that there is no ground for asking an equity court to grant an injunction under the Interstate Commerce law he regards as elementary truth. These two points knock out the whole support from under the Government's argument.

Concerning the term "pooling," which we have all along declared should be interpreted in its narrowest sense, and which Counselor Phelps asserted was so new a word that previous judicial decisions should not be taken as furnishing an authoritative definition of it, Judge Wheeler goes even farther than the railroad lawyers had dared to go. He says that "provision for reasonable, although equal or proportional, rates for each carrier, or for a just and proportional rate for each carrier, or for *a just and proportional division of traffic* among carriers, does not seem to be either a pooling of their traffic or freights, or a division of the net proceeds of their earnings in any sense." In view of the importance of deciding just what pooling means, it is desirable that this point be thrashed out more thoroughly, and for that reason an appeal to a full bench would not be a misfortune.

A division of traffic, perfectly just and proportional, is never practicable. The nearest approach to it is to make an approximate division and then adjust the difference *afterward*. The essential thing, therefore, is the adjusting process, and the law will have to deal with that if it is to be effective. Practically there are only two methods of adjusting. Diversion of shipments almost always makes trouble, and relaxation of effort on the part of the soliciting agents of the stronger line seems to be a very unpopular device; so that it is necessary to resort either to differential rates or to money payments. Money payments are universally held to be equivalent to pooling, whether called by that name or not, and therefore they could not be enforced at law, even if they were not contrary to the Interstate Commerce act; so that, we see, the Joint Traffic Association was shut up to one means, that of empowering the weaker road to reduce, or compelling the stronger road to raise, the rates on competitive business. No one (except the Government's attorney in this suit) has ever claimed that raising or lowering rates would be illegal, unless carried to an unreasonable degree, and therefore it is evident from simple reasoning, aside from the dicta of courts or counsel, that the association in this particular was aiming to employ the one lawful means of restoring stability to the freight rates on the great competitive lines of the country. A consideration of the question of railroad competition, in view of these ineradicable conditions, at once shows the need of a further elaboration of Judge Wheeler's view of the law; and, therefore, we say it would not be entirely contrary to the public welfare if this case were carried to the Supreme Court.

It is doubtful, however, whether even the Supreme Court can give to the public—that is, the press, the instructors of the public—a clear comprehension of the nature of the railroad problem as it now exists in this country. The New York *Tribune*, speaking of the present decision, says: "The ruling of the Court in sustaining the pooling agreement was hailed with a great deal of satisfaction by the railroad men." And the Springfield *Republican*, in a short editorial comment, says, with confident brevity, "The association is a pooling agreement, therefore," etc. Neither of these papers intends to be unjust to the railroads, and yet they both here accuse them, in a sweeping manner, of having violated the Interstate Commerce law—after the court says that they have not. Being convinced that the railroads are trying to increase their respective incomes, which they undoubtedly are, these newspapers nonchalantly tell their readers that the roads are doing this by unlawful means. The fact that there are unscrupulous railroad officers seems to be held sufficient warrant for assuming that all railroad officers are such; and to justify ill-considered editing. The most salient fact in connection with the formation of the Joint Traffic Association is the supremacy of the better element; the law-abiding men have succeeded in controlling the reckless ones; but the newspapers, with few exceptions, seem to be unable to appreciate this Quite likely the railroads deserve much of the obloquy from which they now suffer, for those officers and directors whose motives are honest have never before been half resolute enough in trying to control those whose influence has been constantly evil; but this does not affect the fact that the public interest now demands the utmost endeavors of every public instructor in the line of encouraging this attempt to improve railroad morals—for that is precisely what the Joint Traffic agreement is doing.

We are not of those who say that the prosperity of the country depends primarily upon the prosperity of the railroads, but it is nevertheless true that when the railroads waste their substance in riotous living—or in throwing money into the bottom of the sea, as rate cutters have often done—the whole public is compelled to share in the resulting distress.

The question of the regulation of railroads by the Government is simple, as far as any demand for present action is concerned, and it is unfortunate that so few prominent newspapers are willing to admit its simplicity and declare their opinions concerning it. A powerful combination, making extortionate rates, would be oppressive and intolerable. But the other extreme, a state of unregulated competition, such as Mr. Morrison wants, is sure to work ruin to many railroad properties, to foster discrimination in rates, and to disturb trade in many ways. The public cannot permanently submit to either condition, and some middle ground must be sought. In the effort to cure the evil of former years—monopoly—all hands, both legislatures and railroads, have gone too far, away past any reasonable middle ground. Now, when the railroads attempt to turn about and get back *to* the middle ground, Congressmen, Interstate Commerce Commissioners, editors, and every one that is distressed, unite in a loud remonstrance, for fear the roads will go *beyond* the reasonable point of equilibrium. If the argument supporting this cry had ever been found workable or beneficial anywhere, there might be some reason for espousing it; but, in view of the disastrous results that have followed its supremacy in this country for the last five or six years, it is time to inquire when something more practicable is going to be adopted. Common sense would say, let the railroads go ahead and cure unstable rates, and whenever their prices become too stable - too high—interpose and put a check upon them. To say that this is impossible, that if the railroads are allowed an inch they'll take an ell, is to confess the imbecility of our government.

Mr. Streeter's collision came off at Buckeye Park, O., on the Columbus, Hocking Valley & Toledo Railroad, on Decoration Day, according to programme, and the press dispatches say that there were 18,000 spectators present. One of them, Mr. Peck, Chief Clerk in the passenger department of the road, stood too near the scene of action and had his leg broken by a flying bolt, but aside from this, everything seems to have gone on swimmingly, and we do not read far in the story before we find that Mr. Streeter is going to repeat his exploit as soon as possible in New York, Atlantic City, Chicago and Minneapolis. Evidently, the whole of the 18,000 persons paid their fare to the park, or at least patronized the peanut stands after they got there, for the expenses of the show must be considerable, and any number much less than 18,000 might be expected to arouse only a very moderate degree of enthusiasm in the man who counts the gate money. The engines were started from points 6,300 ft. apart, and were turned from the main line to a temporary side track when within about 500 ft. of the point of collision. The sharpness of the curves at the entrances to this side track is not mentioned, but it must have been quite moderate, as it is stated that the speed at the point of collision was 50 miles an hour. The three coal cars attached to each engine were wrecked, but the cabooses did not suffer much. Dummy brakemen were placed on each caboose in order to make the scene suitably realistic. The engines were both thrown into nearly an upright position. Photographers were thick on the scene, and the illustrated papers this week will doubtless sell like hot cakes.

In France, when for any reason a railroad company wishes to put on a special train for excursions, pilgrimages, etc, and the occasions for them have become very numerous, it was required to apply for permission to the Ministry of Public Works, which referred the application to the government inspecting officer of the district affected, who was required to investigate and report back to the Ministry, which thereupon approved or disapproved, and notified both company and inspecting officers, when the company was free to act. The Ministry now finds this process too long, and has given notice that hereafter the railroad managements need send but five copies of an application for permission, one of these direct to the government local inspector and the others to the Ministry. And the inspector will no longer be required to report on the application, unless he wishes to show why it should not be granted He can simply stamp it "approved," as the officers in the Ministry may do also; whereupon copies so marked will be sent to the company and the inspecting officers, and the train may start. In this way it is believed that authority may be received for a special train within 48 hours of the time the company applies for it.

On the Erie lines west of Salamanca the regulations for making up freight trains have lately been revised, and now read as follows:

1. All air-brake cars shall be placed ahead.
2. Cars for same destination to be grouped together at last division yard, air-brake and non-air-brake cars in separate groups.
3. Live stock in air-brake cars at the rear of air-brake portion of train; live stock in non air-brake cars next behind air-brake cars.
4. Cars containing freight of a combustible character, or explosives, such as hay, straw, hemp, excelsior powder, oil in tanks, naptha, nitro-glycerine and chemicals, shall not be hauled nearer than fifth car from engine, and, so far as consistent, shall be separated by a few cars from caboose.
5. Empty flat cars, not air-brake, must be hauled near caboose.
6. Cars from way stations must be taken on next to cars for same destination, unless so placing them will require extra switching or will separate air-brake cars.
7. Preferably, all empty cars, not air-brake, should be at rear end of train.

Superintendent Mozier informs us that the plan of rating freight engines by tons instead of by the number of cars, and computing the weight of all trains, which is now in use on all the company's lines, has proved highly satisfactory. The avoidance of delays due to overloading the engines is a noticeable benefit.

The average mileage per year of the locomotives of the Prussian State Railroads has varied from year to year as follows:

1888-89.	1889-91.	1891-91.	1891-92.	1892-93.	1893-94.
20,885	22,119	23.302	23,342	21.615	21,272

This includes all switching, running empty, etc. The train mileage per locomotive in these years was:

13,134	13,832	14,895	14.865	13,491	13,353

On some divisions recently locomotives have been run with two or more crews, but apparently this practice has not spread far, or there would have been a decided increase in the mileage per engine, which, when greatest, has averaged but 64 miles a day, and less than 46 of *train* miles. The *car* movement on the Prussian State Railroads has averaged recently just about 1,000 *axles* daily, taking the system as a whole. There are some cars with three and four axles, but these are so small a proportion of the whole that this movement could have been but little less than 500 cars, or 250 each way daily. In Saxony the average has been about 7 per cent. less, in Bavaria about 37 per cent. less.

Mr. Charles Bennett, a fireman of the Toledo, St. Louis & Kansas City, has performed a feat which we often see mentioned in newspaper romance, but is very seldom done in actual life. On May 22, near Fancher, Ill., when approaching a highway crossing, he saw a little girl three years old playing on the track; and, there being no possibility that the train could be stopped in time, he ran to the buffer beam and, holding on with his left hand, succeeded in pushing the child off the track with his right in season to prevent its being run over; and the girl escaped with slight injuries, from which she has since entirely recovered. The engine ran 26 car-lengths beyond the crossing before it was stopped, although the engineman applied the air and called for hand brakes as soon as the child was seen. The foregoing facts, which we find in a St. Louis paper, are vouched for by the Division Superintendent of the road, Mr. Westrich. The train in question was freight No. 32 and the engine was No. 65; engineer, John Tucker.

NEW PUBLICATIONS.

Statistics of the American and Foreign Iron Trade for 1895. Philadelphia: The American Iron & Steel Association; James M. Swank, General Manager, 261 South Fourth street. 1896.

The complete title of Mr. Swank's valuable annual report is "Annual statistical report of the American Iron and Steel Association, containing complete statistics of the American Iron Trade for 1895, also a brief review of its present condition; also a general review of the iron and steel industries of the United States from Colonial times to the end of 1895." As the reader who is interested in these matters doubtless knows, these reports form the most convenient compendium of iron and steel statistics that can be had. The report for 1895 is dated May 1, 1896.

Mr. Swank says that when general trade conditions began to improve early in 1895 it was evident that the iron and steel business would come up promptly and that the manufacturers would be overwhelmed with orders, and this is what happened. Mills and furnaces were soon taxed to their utmost capacity, prices rose from week to week and continued to rise until September. In that month, however, a reaction occurred and prices fell steadily until the close of the year, although consumption remained active. In brief, the boom of 1895 began in May and ended in October. During the last half of August and until Sept. 7 the price of Bessemer pig ad-

vanced from day to day, the advance in Pittsburgh in the three weeks being fully $3 a ton to $17.75. Bessemer billets advanced in a like amount to $25. In January, Bessemer pig at Pittsburgh was quoted at $9.95 and billets in the same market at $14.60. The prices of Lake Superior ore having been fixed for the season remained favorable to consumers through the year. Steel rails formed the only notable exception to the general rule of reduction in prices during the closing months of 1895. In December of 1894 the price at the mills in Pennsylvania had been reduced to $22 a ton; in June, 1895, it was restored to $24 and in September it was advanced to $28, which price has not been changed. The Treasury deficit, the injection into the tariff debate in the Senate of a demand for free silver coinage and the foreign complications, the end of which could not be foreseen, were serious depressing influences, and in the first quarter of 1896 there was a distinct slackening in the demand for most iron and steel products, and this condition prevails at the date of the report.

The recovery in 1895 was remarkable in its magnitude. In most branches of the iron and steel industry the largest production ever recorded was reached in 1895. The table below shows the production of various articles in 1895 and in 1894:

Articles—Gross tons, except nails.	1894.	1895.
Iron ore from Lake Superior	7,748,932	10,438,268
Pig iron, including spiegel and ferro	6,657,388	9,446,308
Spiegeleisen and ferro-manganese	120,180	171,724
Bessemer steel ingots	3,571,313	4,909,128
Open-hearth steel ingots and castings	784,936	1,137,182
All kinds of steel	4,412,032	6,114,834
Structural shapes, not including plates	363,305	517,920
Plates and sheets	682,900	991,459
All rolled iron and steel, except rails	3,629,439	4,883,438
Bessemer steel rails	1,016,013	1,299,628
Total of rails	1,021,772	1,306,135
Street rails, included above	157,457	163,109
Iron and steel cut nails, in kegs	2,425,060	2,129,894
Iron and steel wire nails, in kegs	5,631,801	5,841,403
Iron and steel wire rods	673,402	791,130
All rolled iron and steel, including rails	4,642,211	6,189,574

The production of iron ore as ascertained by Mr. John Birkinbine amounted in 1895 to 15,957,614 gross tons, against 11,879,679 tons in 1894.

It would be impracticable in a notice like this to summarize the substance of the numerous statistical tables given in the pamphlet. These cover average monthly prices of iron and steel for several years, prices of iron and steel for 29 years, prices of ore and of wire nails for a number of years, imports and exports of iron and steel, tables of consumption, of production and of stocks, of various items of iron and steel products and numerous other matters.

An interesting and important appendix to the report is the review of the American iron trade from colonial times, written by Mr. Swank. This includes a very brief sketch of the trade conditions down to our civil war, and gives many important facts as to the growth of the industry, in an accessible and useful shape.

The *Engineering Magazine* for June has three articles which are especially worth the notice of our readers. One is by Mr. J. Selwyn Taite, under the title of the "Fruits of Fraudulent Railroad Management." This is an important article, and will attract much attention, as it ought. Mr. Charles B. Going writes on the "Absence of Facts About the Nicaragua Canal," making a synopsis of the remarkable report of the Engineer Commission, concerning which our readers have already had a good deal of information through these columns. An article of 19 pages is on "Bank Revetment on the Mississippi River," by Mr. H. St. L. Coppée. This is a careful account of the work done by the United States Engineers for protecting the banks of the Mississippi, and is illustrated from photographs showing the methods of making and sinking mats, of protecting banks with pole grillage and stone paving and of other details of the protection works.

The American Engineer, etc.—Our esteemed contemporary, or, as Mr. Forney prefers, "cotemporary," the *American Engineer, Car Builder and Railroad Journal*, has undergone another change. It will be remembered that just prior to its last change before this the journal was the *American Engineer and Railroad Journal*, party of the first part, and the *American Car and Locomotive Builder*, party of the second part. About the beginning of the present year the two journals were combined under the present title in which can be discerned traces of the names of various defunct journals. The change which has been made in the June number is not of title, but of form. The periodical has been reduced to the size of the *American Engineer* before the combination; that is, 9 in. × 12 in., and we have no hesitation in saying that the appearance of the journal has been greatly improved and that it is decidedly a more convenient pamphlet to handle; and yet we have not the slightest notion of changing the form of the *Railroad Gazette*, being just that hide-bound and conservative.

Performance of the Purdue Locomotive "Schenectady"*

BY PROF. W. F. M. GOSS.

The Experimental Locomotive of Purdue was built by the Schenectady Locomotive Works in 1891. Its principal dimensions are as follows:

Total weight (makers' figures)	85,000 lbs.
Weight on four drivers (makers' figures)	56,000 lbs.
Total wheel base	22 ft. 11 in.
Driving-wheel base	8 ft. 6 in.
Drivers, outside diameter of tire	64 in.
Cylinders:	
Diameter	17 in.
Stroke	24 in.
Ports:	
Length	16 in.
Width of steam ports	1¼ in.
Width of exhaust port	2½ in.
Richardson Balanced Valves:	
Maximum travel	5 53 in.
Outside lap	¾ in.
Inside lap	⅛ in.
Boiler:	
Diameter waist at front end	52 in.
Diameter tubes	2 in.
Number of tubes	200
Width of firebox	34⅛ in.
Length of firebox	72 in.
Total heating surface, square feet	1,214.4
Grate surface, square feet	17.5

This locomotive is mounted in the laboratory in such a way as to allow its action to be studied and its performance tested while the engine is run at any desired speed and under any load, the conditions being similar to those of the track.

Power of Locomotive "Schenectady."—The indicated horse power developed while running under a full throttle and with a boiler pressure of 130 lbs., is shown by Table 1.

TABLE I.—INDICATED HORSE-POWER AT DIFFERENT SPEEDS AND AT DIFFERENT CUT-OFFS. BOILER PRESSURE 130 LBS. THROTTLE FULLY OPEN.

Speed in miles.	Rev. per minute.	Approx. cut-off in inches of stroke.		
		6 in.	8 in.	10 in.
15	81	190	270	
25	135	293	368	455
35	188	298	431	501
45	242	302	437	
55	296	292	438	

The power of any locomotive is limited at low speeds by its adhesion, at higher speeds by the capacity of its boiler. For example, at a speed of 15 miles, it is possible to run with a wide open throttle under a cut-off as long as 8 in.; an attempt to run with a 10 in. cut-off was found to involve frequent slipping, the occurrence of which made it impossible to maintain conditions, but had the engine been upon the road there is no question but that this condition could have been maintained. An increase of speed to 25 miles so reduced the mean effective pressure that the 10-in. cut-off could be maintained, but at this speed the use of a longer cut-off again led to trouble by causing the wheels to slip. On the other hand, tests at speeds of 35 miles and over gave no trouble from slipping, but an attempt to lengthen the cut-off beyond the limits for which results are given in Table I. failed through lack of steam. The 10-in. cut-off test at 35 miles was successfully run only after the double-exhaust nozzle had been reduced from 3 in. diameter to 2¾ in. diameter. It will be seen from these considerations that Table I. represents conditions of speed and cut-off which embrace very nearly the entire range of action for this locomotive while running under a full throttle.

Maximum Power.—Much interest has been manifested in information which tends to establish the maximum limits of power which can be developed by a locomotive. Engines of the size under consideration are commonly credited with a capacity of not less than 800 H. P., while as a matter of fact the highest horse power in Table I. is 501. A higher steam pressure would tend to increase the power of the engine tested and a change in valve proportions might also affect it; but judging from the data given it does not appear that any locomotive having a cylinder and boiler capacity no greater that that of "Schenectady" could be forced beyond 600 H. P.

Power and Speed.—In general the power of an engine is proportioned to its speed, that is, if the speed is doubled, all other conditions remaining the same, the power is doubled. This general relation must of course exist in a locomotive, but in this particular type of machine, it is not possible to change the speed and maintain *all other conditions constant*. In fact, when the speed is changed, a number of other factors insist upon changing also; and herein lies the chief difficulty which must be met by all who enter upon an analytical study of locomotive performance.

An important factor which is affected by a change of speed is the steam distribution in the cylinder, arising from the changed time-interval during which the steam must enter and leave the cylinder. It is evident that a higher speed must result in an increase of power excepting under conditions which make the loss of mean effective pressure equal to, or greater than, the gain in speed; that is, excepting where the loss in the amount of work per revolution is equal to or greater than the gain in the number of revolutions. The relation between speed and mean effective pressure as developed by tests is well shown by Table II. Thus for a cut-off of 6 in. the mean effective pressure is reduced from 43.5 lbs. at 15 miles to 18.3 for the same cut-off at 55 miles.

TABLE II.—MEAN EFFECTIVE PRESSURE AT DIFFERENT SPEEDS AND DIFFERENT CUT-OFFS BOILER PRESSURE 130 LBS. THROTTLE FULLY OPEN.

Speed in Miles.	Rev. per Minute	Approx. cut-off in inches of stroke.		
		6 in.	8 in.	10 in.
15	81	43.5	61.9	
25	135	30.5	51.2	63.3
35	188	29.6	42.4	48.0
45	242	23.2	34.2	
55	296	18.3	27.4	

Tables I. and II. both give evidence that the power of the engine tested increases with increase of speed up to about 35 miles per hour (188 revolutions per minute). Above this limit the power remains practically constant.

Power and Cut-off.—An inspection of Table I. with reference to the power developed at different cut-offs on the engine tested will aid in forming an opinion as to the sufficiency of the mechanism for varying the cut-off. The reverse lever quandrant on this engine has notches which are spaced three-quarters of an inch from center to center. When the lever is in the first, or second, or third notch the approximate cut-off is respectively 6 in, 8 in. and 10 in. A change in the position of the lever from the first to the second notch or from the second to the third, as shown by the data presented, involves a change in the output of power varying from 70 to 146 H. P. Half the changes represented by the data result in a change of more than 135 H. P. A change from the first to the second notch gives an increase of about 50 per cent. of the power developed with the lever in the first notch.

Steam per Indicated Horse Power per Hour.—Engineers unfamiliar with the performance of the locomotive often characterize it as an extremely wasteful engine. The conditions under which it works are necessarily severe, but it will be seen from Table III. that its performance compares favorably with that of any other class of single-cylinder, high-pressure engines.

TABLE III.—STEAM CONSUMPTION PER INDICATED HORSE POWER PER HOUR AT DIFFERENT SPEEDS AND D FFERENT CUT-OFFS.

Speed in Miles.	Rev. per Minute.	Approx. Cut-Off in Inches of Stroke.		
		6 in.	8 in.	10 in.
15	81	29.93	27 66	
25	135	28.06	26.60	28.60
35	188	26.93	26.28	30.10
45	242	28 60	28.45	
55	296	30.64	32.00	

This table brings out very clearly several facts concerning the performance of the engines tested, and these may be summarized as follows:

With a full throttle the consumption does not under any conditions of speed or cut-off exceed 32 lbs. per indicated horse power per hour, and under favorable conditions it falls to about 26 lbs. per indicated horse power per hour. In this connection it may be noted that with a higher steam pressure this engine has given 1 H. P. per hour on less than 25 lbs. of steam.

The steam consumption per indicated horse power per hour varies with the speed and is minimum for a speed of 35 miles an hour.

The steam consumption varies with the cut-off and is not minimum for the shortest cut-off except for a speed of 55 miles an hour. This fact confirms an opinion which was reached after a study of previous tests upon this engine; namely, that a cut-off of about one-third stroke gives maximum results. If the load to be carried is light, it is more economical to use an 8-in. cut-off with a partially closed throttle, than to run with a shorter cut-off and a full throttle.

It should be noted, however, that the loss in efficiency resulting from too short a cut-off is extremely small, whereas such loss increases rapidly if the engine be allowed to run with a cut-off longer than that which gives the maximum efficiency. In case of doubt it is certainly safer to use the short cut-off.

Coal per Indicated Horse Power per Hour.—Table IV. showing the weight of coal consumed per indicated horse power per hour, gives a measure of the combined efficiency of the boiler and engine.

TABLE IV.—COAL PER INDICATED HORSE POWER PER HOUR AT DIFFERENT SPEEDS AND AT DIFFERENT CUT-OFFS.

Speed in miles.	Rev. per minute.	Approx. cut-off in inches of stroke.		
		6 in.	8 in.	10 in.
15	81	4.45	4.19	
25	135	4.19	4.45	5.68
35	188	4.18	4 54	6.32
45	242	4.33	5.60	
55	296	5.12	6.03	

The boiler is most efficient when working under its lowest power, while the engine is most efficient when working at its maximum power. The efficiency of the two combined is highest somewhere between the limits of the power developed at 35 and at 15 miles per hour, or it must be coincident with one or the other of these limits. Table IV. shows a nearly constant consumption of coal per indicated horse power per hour for speeds below 35 miles per hour, but above this speed the consumption increases rapidly. For the 6-in. cut-off it is minimum at 25 miles per hour, and for the 8-in. cut-off at 15 miles; it is curious that the value given for these two points is the same.

Critical Speed.—It has been shown (paragraph 4) that with the throttle fully open and the cut-off constant the power of the locomotive increases as the speed is increased up to a certain point, after which the power does not increase, even though the speed is increased. I have called that speed which represents the point on the scale where the power ceases to increase the *critical speed*. It is always a little dangerous and commonly unnecessary to attempt the introduction of a new term, and the caption of this paragraph was chosen with some hesitation. Its choice sprang from a desire to give emphasis to a series of relationships which are noticed in the preceding paragraphs and which, so far as I am

* A paper read at the last meeting of the Western Railway Club.

informed, have not before received attention. It is an interesting fact that the steam consumption per horse power per hour is lowest when the engine is running at its critical speed (paragraph 5), and equally interesting is the fact that the coal consumption per horse power per hour (paragraph 6) is practically constant for all points below the critical speed. These relationships are of such a character as to make it appear probable that they will be found true for all locomotives, in which case the critical speed becomes an important factor to be considered by the designer of locomotives. For the locomotive tested, the critical speed is about 35 miles per hour (188 revolutions per minute), or approximately 200 revolutions per minute. It is possible that different valve-settings or different valve proportions may have some effect upon the value which is here assigned to the critical speed, but so long as the link motion is used the limits of its variation cannot be great.

An Argument for Large Wheels.—It is evident from the preceding discussion that for highest efficiency, the speed of rotation of any locomotive should agree with the critical speed. This for the locomotive tested is about 200 revolutions per minute. If high rates of speed are demanded, considerations of economy require that the diameter of drivers be increased to such proportions as will give the desired rate, without exceeding the critical speed. Some comparisons from the data given will serve to emphasize this statement.

Friction being neglected, the engine experimented with will give 109 4-lbs. pull to the draw-bar for every pound mean effective pressure that is exerted in the cylinders.

Its power becomes maximum at about 188 revolutions per minute (35 miles an hour). The mean effective pressure at this speed when cutting-off at 8 in. is shown by Table II. to be 42.4 pounds. The equivalent pull at the draw-bar is

(1). $42.4 \times 109 = 4{,}622$ lbs.

If, now, it is required to increase the speed of this engine from 35 to 55 miles an hour, the revolutions must be increased from 188 to 296, causing the mean effective pressure to drop to 27.4 lbs. The equivalent pull at the draw-bar at the higher speed is

(2). $27.4 \times 109 = 2{,}987$ lbs.

Suppose, now, that instead of increasing the speed of rotation from 188 to 296, the diameter of the drivers be increase from 63 in., the present diameter, to 99 in. With these proportions the engine would give 69.4 lbs. pull at the draw for each pound mean effective pressure. But a speed of 55 miles would now involve only 188 revolutions per minute, and the mean effective pressure would, therefore, be 42.4 lbs., which would give a pull at the draw-bar of

(3). $42.4 \times 69.4 = 2{,}943$ lbs.,

or, practically, the same with that obtained at the same speed with the smaller wheels.

A similar comparison based on the mean effective pressure obtained with a 6-in. cut-off gives results for 55 miles as follows: With 63-in. drivers the pull at the draw-bar will be

(4). $18.3 \times 109 = 1{,}995$ lbs.

With 99 in. drivers

(5). $29.6 \times 69.4 = 2{,}054$ lbs.,

which is a gain in draw-bar stress in favor of the larger drivers.

These comparisons, based as they are upon results of accurately conducted tests, justify the conclusion that after a speed of revolution of about 200 per minute is reached, a pull at the draw-bar can be sustained equally well by increasing the diameter of wheels or by increasing the speed of rotation. Strictly speaking, this conclusion should be limited in its application to locomotives having the same valve action with that of the engine tested, but "Schenectady" may be safely taken as typical of a large class of locomotives now in service.

While the comparisons which have been made are based upon the assumption that there is no loss in the transmission of power from the cylinders to the draw-bar, it can be shown that the power equivalent of the frictional losses is greater for high than for low speeds of rotation. The effects of such friction, if allowed to influence the preceding comparisons, would be to reduce the calculated draw-bar pull for the 296 revolution tests by a larger amount than for the 188 revolution tests. In other words, when engine friction is taken into account, conclusions are in favor of larger drivers.

Accepting the fact as established that within limits that can be pretty definitely defined, the draw-bar pull is not reduced by increasing the diameter of the drivers, we may inquire concerning the incidental advantages which are likely to result from the use of larger wheels for higher speeds. It has already been shown that the locomotive is most efficient for speeds at or below its critical speed, and that its efficiency declines rapidly as this speed is exceeded. This phase of the matter may now be approached more in detail.

If with the present wheels (63 in. diameter) the locomotive under consideration is required to run at a rate of 55 miles, it must make 296 revolutions per minute. The table shows that at this speed, and with a full throttle, and a cut-off of 6 in., the engine requires 30.6 lbs. of steam per horse power per hour. If wheels 99 in. in diameter were substituted for those it now has, the revolutions would fall to 188 and the steam consumption to 26.9 lbs., a gain in steam consumption of 12 per cent. A similar comparison of results for tests at 8 in. cut-off gives a gain for the large wheels of 18 per cent.

This saving of steam resulting from the greater economy of the engine reduces the demand upon the boiler; fuel is saved both because less steam is required and because the boiler is permitted to work under conditions more favorable to economy.

The saving of coal which would result from the use of large wheels for high speeds is even more pronounced than that of steam. Thus it will be seen by reference to Table IV. that, with a full throttle, and a 6-in. cut-off, the engine with its present wheels requires, at 55 miles, 5.12 lbs. of coal per indicated horse power per hour. If, however, its wheels are increased in size, to bring its revolutions down to 188 per minute, its coal consumption would be reduced to 4.18 lbs. A similar comparison for a cut-off of 8 in. gives a saving of 23 per cent.

There should also be credited to the larger wheels a saving in cost of repairs on engine and track, a saving in oil, and a better and more precise action of the whole mechanism of the machine, which in time would doubtless lead to still other economies.

All this is accomplished without loss of effort at the draw-bar, excepting when the speed of the engine is below 35 miles an hour.

Table V. presents a convenient summary of the arguments for large drivers.

TABLE V.—RESULTS OBSERVED ON LOCOMOTIVE "SCHENECTADY" AND SIMILAR RESULTS, ON THE SUPPOSITION THAT THE DIAMETER OF DRIVERS HAD BEEN INCREASED IN THE RATIO OF 35 TO 55. SPEED CONSTANT AT 55 MILES AN HOUR. THROTTLE FULLY OPEN.

	Present drivers 63-in. diameter.	Proposed drivers 99-in. diameter.
Revolutions per minute	296	188
Approximate speed in miles per hour	55	55
Indicated horse power (Table I.).		
6-in. cut-off	292	298
8-in. cut-off	438	4.1
Tractive force, pounds.		
6-in. cut off	1,995	2,054
8-in. cut-off	2 987	2,943
Steam per indicated horse power per hour (Table III.).		
6-in. cut-off	30 6	26.9
8 in. cut-off	32.0	26.28
Coal per indicated horse power per hour (Table IV.).		
6-in. cut-off	5.12	4.18
8-in. cut-off	6.03	4.54
Gain or loss in indicated horse power with 99-in. drivers.		
6-in. cut-off	Gain..... 2.9 per cent.	
8-in. cut-off	Loss. ... 1.4 per cent.	
Decrease in steam consumption with 99-in. drivers.		
6 in. cut-off	12 per cent.	
8 in. cut-off	18 per cent.	
Decrease in coal consumption with 99-in. drivers.		
6-in. cut-off	18 per cent.	
8-in. cut-off	23 per cent.	

It is admitted that there are mechanical difficulties to be overcome before wheels of very large diameter can be used, and that there are in this country conditions of service which seem to require some sacrifice in performance at high speed in order that certain desired results may be secured at low speed. These are matters which emphasize the other side of the question, a discussion of which does not fall within the purpose of the present paper. The observations which have been described are believed to be correct. If the argument based upon these is not at fault, it is clear that the field presented is one which invites careful study and experiment. It is to be noticed in this connection that during the last few years locomotives have been given wheels which, while yet too small for highest efficiency at the rates of speed at which locomotives are driven, are much larger than those formerly used; all of these large-wheeled engines have proved very economical in the use of water and coal. These results from the road serve to strengthen the conclusions which are based upon the work of the laboratory.

Physical Experiment in Relation to Engineering.*

Physical experiment, so far as it has relation to our own profession, may fairly be considered to serve three distinct purposes. In the first place, from the purely academic or education point of view, it is most important and helpful in the training of engineering students. Then, secondly, what may be called purely physical experiment is necessary to supply us with most of our most important constants, whether connected with the thermal properties of steam, the electro motive force of a Clark cell, the density of water, the elasticity of steel, the co-efficient for a *vena contracta*, or a thousand other matters of similar nature. Lastly, technical experiments, which are essentially physical experiments, but of a much more complex nature than those of the physical laboratory (although not on that account more difficult to carry out) are necessary for determining many matters, such, for example, as the efficiency of a dynamo, the steam consumption of an engine, the flow of a river, the resistance of a ship, or even the deflection of a girder under a moving load.

Let us consider, in the first place, the purely educative or academic type of experiment. Here the first requirement is the very simple one—which, indeed, may be served by an endless variety of experiments, extending far beyond the limit of physics—that the student should learn first to see and to measure, and then to write down what he has seen and measured. . . . Perhaps those whose work lies greatly in experimentation, like my own, know best how very hard it is to find assistants, unless they have been trained in a laboratory, who can be trusted at first even to take quarter-hourly readings of a steam gage or a counter, or any such duty, ridiculously easy and simple as it appears. To ask an untrained man to count the revolutions of an engine which has no continuous counter attached, or to read the dials of an ampere-hour meter, at exactly regular intervals of time, is merely to court disaster. . . . The ordinary mind does not naturally and at once see, and see accurately, the simplest thing that is before the eyes. One has to look, to exercise conscious mental effort, as well as merely to see, and we all of us required to be taught how to look, even in these most simple matters. And when the enforced looking has to be done at exactly a particular time and no other, the average mind is apt to find the whole process an intolerable burden, all the more because it is inclined to despise the work as being too childishly easy for consideration at the very time when it is failing to carry it out. . . .

We may claim to have a first interest in certain physical results, because of the extraordinary frequency with which we have somehow or other actually to make use of them—I mean a real live use, and not merely a use in an examination question, or in a text-book or a lecture. Not only would our whole work become mere guesswork without the knowledge of these results, but, having this knowledge, we are compelled by the very nature of our work to make such continual use of it that probably we are much more familiar both with the figures concerned and with the phenomena which they represent, than even the men to whose magnificent accuracy and unlimited diligence we owe their original investigation and determination. I mean, of course, such results as refer to the thermal relations of water and steam, to the calorimetry of fuels generally, to many hydro-dynamic problems, to most problems in elasticity and what is clumsily called the strength of materials, to frictional questions, to innumerable problems relating to electrical matters, and certainly to an enormous number of matters bearing on mechanics, which, of course, is to be considered as a branch of physics.

I feel so strongly this sense of our paramount interest in certain physical problems that I have not hesitated sometimes to resent the way in which physical writers and speakers are occasionally inclined to instruct us how to express our ideas, for example, as to mass and weight, and sundry vital matters of that kind. I really think that people who have to deal with these matters as much, as often, and as thoroughly as we have, and who are on the whole reasonably competent beings, may be assumed to know how best to manage our own affairs in these respects. Mechanics are to us the breath of our nostrils, and not a mere vehicle for examination papers; and it should be remembered that the requirements of the latter case may be very different from those of what I may venture to call "real life." I feel some satisfaction in remembering that the only fatal case of a misused "g" that I can call to mind was on the part of a physicist, whom we all admire none the less for the way in which he scolds us, but who in the very act of showing us the way we ought to use that symbol, proved conclusively that all submarine cables would break by their own tension while lying on the sea bottom. . . .

But having spoken so strongly of engineers as being the users of certain physical results, I must look at the other side of the matter. We engineers may have, as I urge, more interest in these matters than anyone else, but it is certainly true that we have not ourselves to thank for the determination of the results which we require and which we make so much use of. For practically the whole of these results—results without which our profession would hardly exist, would at best be a mere trade—we are indebted to workers in physical science pure and simple, men without the least taint or suspicion of technical or utilitarian intent. It would therefore ill become us engineers if we were to say or do anything which should, even in the most indirect fashion, tend to belittle the work of pure physicists, on which every day shows us more how much we are dependent. Our gratitude is so real and so deeply stated that we need not, and do not, even resent the expression of regret which has sometimes been heard from a discoverer, that what he has done should be of any use whatever. . . .

In a physical experiment of the second category the primary points may be said to be, first, that the object of the experiment should be single, definite, isolated, separable and separated from all surroundings; secondly, that it should be general in its nature, and should not relate merely to one special case; next, that as a problem it should be capable of exact determination; and, lastly that the final result should be as nearly absolutely accurate as it is possible for any physical determination to be. Take as examples such matters as the determination of the density of steam, of the variation of the specific heat of water with change of temperature, of the calorific value of pure carbon, or of the mechanical equivalent of heat. Such problems properly stated admit each of one exact solution, one answer which is absolutely right, even in the mathematical sense of that phrase. It is the highest object of the physicist, in dealing with such a problem, to obtain the right solution. He spares no pains to obtain it, he determines each minute correction with the patience and care of a man who knows that the value of his whole work may be vitiated by single overlooked source of error, even of the smallest magnitude. We engineers are possibly in some danger of forgetting occasionally, in view of the familiarity and matter-of-course ness of certain figures with which we have frequently to deal, that just these everyday and familiar numbers, on

*A few extracts from the "James Forrest" lecture delivered before the Institution of Civil Engineers (London) May 7, 1896, by Dr. A. B. W. Kennedy.

account of their very importance, were those which required and obtained for their determination the most careful, exhaustive and accurate experimentation in the hands of the most experienced physicists.

After speaking in this fashion of the nature of experiments in pure physics, it may sound at first absurd, but it is nevertheless true, to say that physical experiments in the third category—the technical experiments which we engineers have so often actually to carry out—do not fall under a single one of the conditions which I have just given as characteristic of experiments in pure physics. We cannot, even under the most favorable circumstances, put before ourselves exact and isolated problems; we have much more often to deal with special than with general cases; we cannot choose problems which are capable of finally exact solution; and, therefore, lastly, we should treat the matter entirely wrongly if we attempted to obtain more than a certain limited degree of accuracy in our solution—an accuracy very limited indeed when compared with the all but mathematical accuracy with which problems in pure physics can be solved. . . .

Hence, as the experimenter cannot for a moment pretend, and should not for a moment delude himself into supposing that his results could be more accurate than his data, it is his first duty in this line of work to find out within what limits of accuracy his experiment can be carried out, and, when he has obtained his results, to state it only within these limits. Under these conditions the statement of a result in round figures is often much more accurate than its statement down to the last decimal place which appears in the arithmetic. I have heard it said by some of the students of the greatest of our physicists, Lord Kelvin, that this was a point upon which, even in a great deal of purely physical work, their master always insisted most strongly. But I am afraid that it must be admitted, as a weakness of much of our engineering experimentation, that its results are given in figures which are absolutely ludicrous as indicating the value of the quantities actually measured. In these matters, perhaps, our friends in America are even worse than we are, and those of us who have anything to do with steam-vessels or with steamship trials are perhaps the worst sinners.

I suppose no physical problem could very well be much more complicated than that (I ought rather to say those) involved in the carrying out of a marine-engine trial at sea, especially when power and speed are both concerned. When it is considered that the final result depends on the accuracy of our knowledge of the dimensions of the steam-engine itself, and of the steam-engine indicators, on the uniformity [of elasticity and proper scale of the indicator springs, the accuracy with which the revolutions are observed, the accuracy of timing on the mile and of observing the distance at the same time, to say nothing of the assumption that the indicators themselves and their gear, unlike every other thing in the universe, are entirely devoid of hysteresis, it will be seen how entirely out of the question it is that the figures obtained, even for a single run in one direction, should admit of statement in, say, more than three figures. When to this is added the uncertainty of the method of averaging speed as between a number of runs under different conditions as to tide and wind, the matter becomes still more striking. Or, when coal and water are also to be measured, and the weighing or measuring of both, and the calibration of all the heavy apparatus used for the purpose, as well as the personal errors due to making observations of large quantities under awkward physical conditions, in a minimum of time and in the worst of atmospheres, are considered, the uselessness, and, indeed, the absolute inaccuracy, of extremely minute figures become absolutely glaring. It is sometimes useful, no doubt, under these conditions, to work out results to four significant figures for the sake of mere arithmetical checking; but no one who has had anything to do with the matter would suppose for a moment that more than three figures were of the least importance, and the statement of results of observations in five or six figures merely causes the enemy to scoff. Let me again say here that I am not suggesting, and I do not think that an experiment of a technical nature is unscientific because its result is only capable of expression within one or two per cent. instead of within one or two hundredths per cent. I wish only to urge very strongly that in a really scientific spirit such an experiment must be undertaken only with a distinct recognition of its limitations, and of the limitations of accuracy of result such as I have roughly indicated. But I must claim for technical experiment that it is truly scientific work if only it be conducted with full recognition of its conditions and limitations, and not as if it were a laboratory experiment badly done—a mistake which I fear is too often made.

To anyone who wishes to realize to the full the difficulty of dealing with, or applying, the very simplest kind of experimental result, I recommend the maddening task, so often lightly spoken of by those who have not tried it, of calibrating indicator-springs, and then trying to apply the results to the correction of the corresponding indicator diagrams.

The fact is that no one can usefully apply physical results who has not himself studied the methods by which these results are obtained, either by the royal road of work in a physical or technical laboratory, or by the hard and up-hill method of self-education in the making of technical experiment, without the advantage of the preliminary training which I have mentioned earlier; and hence the importance of the knowledge of how to make accurate observations, which I have insisted upon as a thing quite apart from the knowledge of the actual figures to be obtained by such observation. It would perhaps be cruel to say that no one can usefully apply physical results who has not studied the methods by which they are obtained, were it not that nowadays the possibility of such study is open to everybody. One may therefore state the truth in this matter without the fear of making anyone unhappy. I do not know whether I should be far wrong in suggessing that a certain amount, perhaps a great deal, of the very rapid improvement which has taken place in late years in engineering practice in respect to efficiency in the working of machinery, economy in the production of energy, and economy also in the use of material, has been due directly or indirectly, or both, to the growth of the habit of knowledge of experiment among the present generation of engineers. No one who is familiar with the progress in such matters as I have this evening dealt with, during the last twenty years, and has noted the extraordinary development which has taken place, can fail to be struck with it. No doubt a considerable part of this development has been due to the better education generally of engineers, and particularly to the great extension of engineering literature, in which undoubtedly the engineering newspapers have played a most honorable and important part. But these general causes in themselves would not, I believe, have been sufficient if it had not been for the contemporaneous development of what I may venture to call experimental training, accompanied by a demand on all hands from inventors; manufacturers, and even from the public, for reasonably exact numerical statements in relation to every-

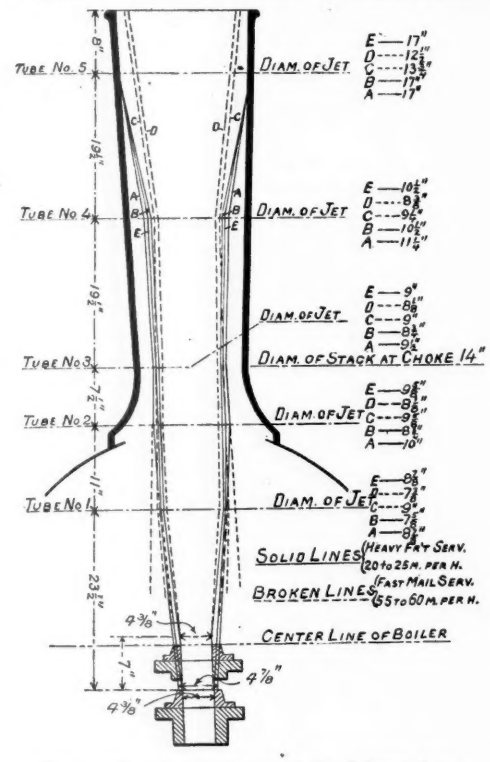


Diagram Showing the Form of the Exhaust Jet—Experiments by Mr. J. F. Deems.

thing which can be measured, instead of the vague generalities which used to pass muster as critical examination of the advantages and disadvantages of any new proposals.

I hope I need not say here that I quite recognize that an engineer's life is not made of experimentation, and that the work of doing is even higher than that of measuring, at least from our point of view. But in dealing with my subject of to-night, I am, of course, bound to take up and emphasize this aspect of engineering work. I hope that it may be considered that I have been able to justify my choice of a subject which at first might appear so limited, but which in reality I believe so important, as that to which I have addressed myself this evening—the relation of physical experiment to engineering.

The Form of the Exhaust Jet.

At the April meeting of the Western Railway Club an interesting addition was made to the volume of information about locomotive exhaust in a paper by Mr. J. F. Deems, Division Master Mechanic, Chicago, Burlington & Quincy. We reprint Mr. Deems' paper below, nearly in full:

What Mr. Crosman has seen fit to designate as "Another Glimpse of the Exhaust Jet," will be simply a recital of some recent experiences as a member of a committee to look into the question of proper height and form of exhaust pipes and arrangement of other draft appliances for certain engines. In order to try and get some information on the subject, it was decided to fit up an engine so the pipe could be adjusted to height from the running board, by a system of levers through a range of 7 in. while the engine was in actual service; a vacuum gage was also applied to assist in determining the effect of the exhaust on the smokebox vacuum as the nozzle was moved up and down. When everything was in readiness the engine was put in different kinds of service, and by noting the effect of the exhaust on the fire as the height of the pipe was altered, and also by noting the vacuum in the smokebox as shown by the gage, we finally decided on certain figures and prepared our report accordingly, adding in the nature of an appendix that the all-essential—the all-important—factor was the relative location of nozzle and choke of stack, which should be such that the jet of steam would fill the stack at the choke at all times, and thus produce the much talked of piston or pump action; and in this position we seemed to be well supported by the testimony of others who had tilled the same field.

As showing how generally this idea has prevailed, I believe it would not be improper to quote some opinions on the subject: The Committee of the American Railway Master Mechanics' Association on this subject in their report in 1894, under the head of "conclusions," have the following: "It is important that the contracted portion of the stack and the exhaust nozzle be so located that the steam will strike the stack at or below the contracted portion; it was found that a variation in the position of the choke in a stack did not materially alter the vacuum when the steam jet struck the stack below the choke, but when the exhaust nozzle was raised and the choke lowered so that the steam jet struck above the choke, the vacuum was materially reduced."

In the discussion of this report Mr. A. E. Mitchell said: "I have run a stack absolutely straight for 8 in. (at the choke), so that, regardless of the position of the exhaust nozzle, I would always fill my pipe. The exhaust steam would always fill that pipe at some point in the 8 in." Mr. A. E. Benson said: "I have had some little experience in this matter, and I find that the secret of it is in getting your exhaust pipe down to such a point that your steam will just fill the stack. If it is a 15-in. stack or a 14-in. stack, in my estimation it makes very little difference. But you must get that piston action in the stack. You must get your nozzle down so that the steam will expand sufficiently to fill the stack at the base and no more. But I have found on every engine in which I have put single nozzles that the great secret of it lay in the fact of getting the exhaust pipe just high enough to fill the stack at the base." Mr. Geo. Gibbs said: "My experience coincides with the conclusions of the committee." As late as June 27, 1895, Mr. J. Snowden Bell seems to agree with this view in quoting approvingly some remarks made by Mr. C. H. Quereau at the November, 1893, meeting of this club, which are as follows: "As soon as the exhaust strikes the stack it must act as a pump, the stack being the cylinder and the steam the piston. It therefore follows, that to be most efficient the exhaust should fill the stack from the base to the top, the length of the stack corresponding to the stroke of the pump." I am sure none of these gentlemen was more firm in the faith than was our committee when we signed the report.

Soon after our report was prepared, and as I supposed our work completed, a member of the committee wrote me, calling attention to a very simple device described by Professor Goss as having been used at Purdue University for the purpose of ascertaining the exact outline for the exhaust jet, and suggested that we try the same with special reference to determining the suggestion by Professor Goss—that the jet becomes parallel before entering the stack—as we could quite readily decide this point by using one of the sliding tubes used at Purdue in connection with our sliding or adjustable exhaust pipe. An engine was at once fitted up as suggested, but instead of using one tube we used five along the path of the exhaust jet, ranging from a point 23½ in. above the tip to one 8 in. below top of stack, or 80 in. above tip.

On our first trip we tried to use the same vacuum gage we had used in our other work, each leg of which was 10 in. long, but we soon found this would not do, as the tubes located near the choke of the stack would take all the water out of the glass the instant they were put in communication by the piece of hose used for that purpose. I was at a loss to know what to do when one of the shop men suggested a novel idea for constructing a longer gage, which proved entirely satisfactory. An ordinary ⅝ in. water-gage glass, such as is in common use on locomotives, was heated and been into a U shape with the ends about 3 in. apart; then by using pieces of ½-in. hose about 2 in. long for couplings, into each end of which he inserted additional glasses, he soon had a manometer, each leg of which was 50 in. long, and before we were through with the work we found they were not much longer than needed. Instead of connecting our vacuum gage direct to the sliding tubes, we used an intermediate air chamber of about 250 cu. in, which gave quite a steady movement to the water in the glass and enabled us to get very accurate readings. The outer ends of the sliding tubes were turned down, tapering so that a piece of small rubber hose could be slipped onto them and make a perfect fit, and then, by using a piece of hose about 4 ft. long, one end of which remained connected to the drum or air chamber, the other end could be changed from one tube to another and readings taken accordingly, a record of which was kept in a log book by having the tubes numbered from one to five, beginning at the bottom. We also used thumb screws to secure the tubes in position when desired, so that by changing the hose quickly from one tube to another while they were held stationary by the thumb screws, it was possible to prove the work very carefully; and I believe it is safe to say this apparatus will measure considerably closer than $\frac{1}{10}$ of an inch, in fact a change of less than $\frac{1}{20}$ of an inch was usually quite noticeable.

The engine was put in various kinds of service, and after each trip the finding were plotted full size and I have here a sketch in which the results of several tests are grouped together for convenience of comparison.

As stated before, in our report we had laid special stress on the matter of having the exhaust jet fill the stack at the choke; and of course supposed we had exactly the proper relations between nozzle and stack to secure this result, and in anticipation of this had arranged the tube at that point so it could be withdrawn into a recess entirely outside of the stack; in fact, we did this with all the tubes in the stack. You can imagine our surprise when, making the first trip, we found that the jet did not fill the contracted portion of the stack by from 4 to 5 in. In fact, the sectional area of the column of steam as compared with that of the inside of the stack at choke is about as 1 to 3 for the largest jet and nearly as 1 to 4 for the smallest. Furthermore we found that a vacuum ranging from 8 to 27 in. was shown in the space surrounding the column of steam; in fact at one time when taking a "run" for a steep hill a vacuum corresponding to 50 in. of water was shown. We also found that Prof. Goss was correct as to the column of steam becoming parallel just before entering the stack; it not only became parallel but in most cases assumed an opposite angle from that shown near the exhaust tip, being contracted in some instances as much as one inch at the choke as compared with a point 7½ in. lower down. This we found to be especially true with a stack measuring 13 in. at the choke instead of 14 in., as shown in the sketch.

The solid lines of the sketch show the form of the jet in heavy freight service at from 15 to 20 miles per hour, while the broken lines indicate fast express service at 55 to 60 miles per hour. Readings were taken for the nozzle in the highest and lowest position in all kinds of service. The solid lines *AA* show the result with the nozzle in the lowest position, or 42 in. from choke of stack when running about 20 miles per hour in heavy freight service, while the solid lines *BB* were produced with nozzle in highest position, or 35 in. from choke of stack under the same conditions. It will be noted that the angle is practically the same, but the column of steam is about 2 in. smaller in diameter up to tube No. 2, while from there to the choke the column is parallel instead of being contracted as in the former case, but approaches more nearly the same diameter at the choke, and that this difference is maintained to tube No. 4, 6½ in. from nozzle, but from there to the top of the stack they are practically the same. It will be noted that after passing this point the expansion or divergence of the lines is very rapid and the stack is filled at a point somewhere near 8 in. from top, from which it would seem there cannot be much of the piston action, and when we come to consider the broken lines *CC* and *DD* which represent a speed of from 55 to 60 miles per hour in express service, there certainly can be none of it, as in this case the steam jet does not fill the stack at any point by several inches, or at least it lacked several inches of filling it 8 in. below the top, and unless the expansion was very rapid above that point it did not fill it at all. Yet with this condition a much higher average vacuum was shown than at the lower speeds where there is possibly a slight piston action near top of stack, the vacuum quite often reaching 20 in. and seldom less than 12 to 13 in. at the choke, and a considerable vacuum was shown for each of the tubes above the choke, being as much as 3 in. at the one near top of stack, and 7 in. for tube No. 4. The solid lines *EE* show the result of enlarging the opening of the tip one-half inch, which gives a result quite different from any of the other conditions.

After going over the work carefully with a 14-in. stack and being convinced that the exhaust jet could not be made to fill it under any ordinary service conditions, the question came up as to what would be the result if the diameter of the stack were reduced, and we applied one 13 in. in diameter at choke only to find that the jet was proportionately more contracted as it approached this point, or with the conditions the same as those that produced lines *AA* with a 14-in. stack we found we got lines approximately the same as *AA* to tube No. 1, and not differing much from there to tube No. 2, but from that point to No. 3 there was a marked difference, as the lines contracted about to the point shown by lines *BB* at tube No. 3, which seems to show that the more the diameter of the stack is reduced the more the jet will be contracted to meet the conditions. I did not plot this line on the sketch, as so many lines would be confusing.

From what experiments we made it seems certain that with every change of exhaust opening, every change of distance between the exhaust tip and stack, whether by altering exhaust pipe or stack, or with every change in diameter in stack, comes a change in the form of the exhaust jet; and it seems possible that, if proper relations are once established, one part should not be altered without some change in the others in order to obtain the best results. It would also seem to be true that during a trip of 100 to 150 miles, especially over a line with varying gradients, with any given arrangement of draft appliances, the form of the exhaust jet undergoes hundreds or perhaps thousands of changes, being appreciably influenced by every change of cut-off, every variation of speed, or possibly by a change of steam pressure, or difference in the volume of air admitted to the tubes, either owing to the condition of fire on grates or irregular opening of the firebox door.

Another point which seems possible, but which our experiments did not cover, is that owing to the different paths by which the gases approach the choke of the stack and consequent difference in the force with which they impinge against the jet, it may lack considerably of being circular at that point.

Another thought that occurs when looking at these lines, showing such a great difference in the form of the jet at high and low speeds, is that possibly the best results can only be obtained by very different construction for the two classes of service.

Prof. W. F. M. Goss (Purdue University): There are two reasons why I cannot say much upon this subject this afternoon. First, while we are making a very extended series of experiments to determine the form and density of the exhaust jet, the work is not yet complete and hence conclusions should not be drawn. The second reason is to be found in the fact that our work is for a committee of the Master Mechanics' Association, and our results should not be published until after they have served the purposes of the committee. I may say, however, that the results which we have are entirely in accord with those which have been presented by Mr. Deems. We have been able, not only to trace the boundary line of the steam jet, but also to establish a series of curves within the jet, each curve being drawn within points having the same velocity. I may say also that we have good evidence concerning the non-existence of the "pump action." This was shown by blocking our slide valves clear of their seats and by opening the throttle until the exhaust pipe pressure equaled that which we found to exist there while the engine was running. The result was a steady blow of steam from the exhaust tip and this gave as good a draft as that obtained by running the engine.

It is quite evident that the form of the jet depends upon the character of the surrounding mechanism. The jet begins to do work upon the gases surrounding it the instant it leaves the exhaust tip. Investigations show that there is a rapid movement of gas from points below the level of the tip, upwa d toward the jet. The gas everywhere tends to move in line with the jet, and the jet requires gas to work upon even after it has passed up into the stack. This explains why there is a strong vacuum at the base of the stack, as has been found by Mr. Deems.

The cross section of the jet is less at the choke of stack than for points lower down, because the gas which is to supply portions of the steam jet at points near the top of the stack must pass into the stack at the base. This current of gas crowds the steam jet and at the choke actually narrows it. I should say, therefore, that the reduced section of the steam jet which appears on Mr. Deems' drawing, is due to the reaction of surrounding currents of gas.

Mr. DEEMS: Did you understand me to say that the form of the exhaust jet was fixed or constant? I understood you to say that I advanced the idea that the form of the jet was only changed when there was some change in the form of construction of the draft appliances, or something of that kind. What I meant to say was, that with any given design of draft appliances, going over a division of 150 miles, especially where the grades are varying, I think the form of the jet changes a hundred or a thousand times, without any change whatever in the construction. It is affected by the cut-off, by the speed, by the amount of air admitted through the grate and the fire-door, and by the steam pressure.

Mr. JNO. MACKENZIE (N. Y. C. & St. L. Ry.): I understand that sparks and gases do not go in line with the exhaust steam, but they separate from the steam, and that is what fills up the balance of the stack. If that is correct, our practice is entirely wrong. We find it absolutely necessary to use a lift pipe or a convey pipe on the low nozzle and by the adjustment of the pipe we can cut the fire at the door or we can cut it at the front end, and by tipping it either one side or the other we can cut it on either side of the firebox.

Mr. G. W. RHODES (C. B. & Q.): I would like to defend Mr. Deems on the point Mr. Mackenzie has raised. If the sparks mix thoroughly in the steam jet, at what point do they mix? Now we all know very well that when we get two liquids and run them together, it is some time before they mix, and it seems to me that this proposition that Mr. Deems has brought out is entirely consistent, that through the great velocity with which the steam leaves the exhaust it does not get thoroughly mixed with the gases and sparks until it gets towards the top of the stack, and I think the sparks are more likely to come around the sides of the stack than to come into this compressed body of rapidly moving steam that is going up in a straight shoot through the stack.

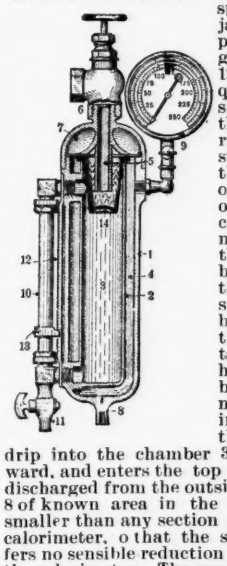
Mr. C. H. QUEREAU (B. & M. in Neb.): I had the pleasure of being a member of this committee to which Mr. Deems has referred, and before saying anything else would say that in my estimation, after looking over the apparatus, and assisting in the tests, that the figures are correct within one-tenth of an inch. They were checked repeatedly and three observers took them.

The thing I wish to speak of specially is an interview I had with a gentleman connected with the operating department of a Western railroad. He is, of course, in a general way, familiar with mechanical department matters, but I suppose never for a moment thought how the exhaust steam produced the suction on the fire, or what was the action of the baffle-plate or anything else in connection with the exhaust. I had a diagram similar to this in my office, and explained to him what the figures, dimensions, etc., meant, and called his attention to the fact that the steam jet did not touch the choke at any place, unless possibly at the top. "Why, certainly," he said, "how else could it be? Anybody would know that if he would think about it at all. How are the gas and steam going to get out unless the steam makes room for the gas?" What I want to illustrate is this; that we had been at it for years, and assumed as a fact that the exhaust must fill the stack at the choke, but here comes an outsider, who has not been taught this, and as soon as he gets an inkling of the actual facts in the case says, "why, certainly." Now if we mechanical men had made experiments along this line and arrived at the facts in the case, it seems to me, the reasons would follow at once, and that this experience should teach us to investigate a little more.

New Form of Steam Calorimeter.*

The calorimeter described in the following paper has been in use in the laboratories of Sibley College in the form described for about one year, although an instrument somewhat similar in construction had been previously used for several years.

The instrument may be described as follows: It consists of two vessels, one being interior to the other; the outer vessel surrounds the interior one so as to leave a space which answers for a steam jacket. The interior vessel is provided with a water-gage glass 10 and a graduated scale 12. The sample of steam whose quality is to be determined is supplied through the pipe 6 into the upper portion of the interior vessel. The water in the steam is thrown downward into the cup 14, together with more or less of the steam; the course of the steam and water is then changed through an angle of nearly 180 deg., which causes the greater weight of water to be thrown outward through the meshes in the cup into the space 3 below in the inner chamber. The cup serves to prevent the current of steam from taking up any moisture which has already been thrown out by the force of inertia. The meshes or fins project upward into the inside of the cup, so that any water intercepted will drip into the chamber 3. The steam then passes upward, and enters the top of the outside chamber. It is discharged from the outside chamber through an orifice 8 of known area in the bottom part, which is much smaller than any section of the passages through the calorimeter, so that the steam in the outer chamber suffers no sensible reduction in pressure by passing through the calorimeter. The pressure in the outer chamber, being the same as in the interior, has the same temperature, and consequently no loss by radiation can take place from the interior chamber except that which takes place from the exposed surface of the gage glass. The pressure in the outer chamber, and also the flow of steam in a given time, is shown by suitably engraved scales on the attached gage. The scale for showing the flow of steam is the outer one on the gage, and is graduated by trial, and gives the weight which is discharged in 10 minutes of time.



The graduations of the scale 12 attached to the inner vessel show, when the index is set properly, the weight of water in lbs. and hundredths which has been separated from the steam. The scale is graduated by actual calibration with water at a temperature of 100 deg., and corrected for a coefficient of expansion so as to be as nearly as possible correct for water at a temperature corresponding to a stream pressure of 100 lbs. This correction is, however, a very small amount and of no practical importance, as it would seldom affect the results by even one one-hundredth of 1 per cent. The percentage of moisture in the steam is found by dividing the weight of water, as shown on the inner reading of the gage, by the sum of this quantity and that shown on the attached gage; the quality or percentage of dry steam by dividing the difference of the readings by the sum.

The accuracy of the instrument depends first on the accuracy of the scales, both of which can be readily verified by experiment; second, upon the complete separation of the water from the steam by the separator. This was tested by a large number of experiments, by discharging the steam from the outer vessel through a throttling calorimeter. Nearly 100 observations were made, the average results of which as given in the following table show the exhaust steam in the conditions tested to have a quality of 99.998 per cent. As it is certain that some loss of heat occurred between the two instruments, it is believed that we can consider with confidence the steam as passing from the inner into the outer vessel perfectly dry and satuated.

*From a paper by Prof. R. C. Carpenter, presented at the St. Louis meeting (May, 1896) of the American Society of Mechanical Engineers.

RESULTS OF TESTS WITH THE SEPARATING CALORIMETER.

Determination of quality with separating calorimeter.					Determination of quality of steam discharged by separating calorimeter with throttling calorimeter.		
Duration run, minutes.	Gage pressure, pounds.	Pounds separated water in run.	Pounds condensed steam in run.	Quality steam, per cent.	Temperature in calorimeter.	Quality steam in exhaust from separating calorimeter.	No. of observations.
25	81.5	1.15	4.45	79.46	281	99.95	6
25	78.2	0 15	5.20	97.2	281.3	100.00	6
25	8 .8	0.525	4.25	89.05	286,5	100.00	6
25	79.5	0 150	4.75	96.94	281.8	99.95	6
25	78.5	0.300	5.000	94.34	282 8	100.00	6
25	77.6	.150	5.45	97 32	28'.3	100,00	6
24	79.5	1 8	4.55	71.65	280.1	99.94	6
24	78 5	1 4	4.90	77.77	279.5	99.9	6
20	83.5	1.15	4.1	77.67	286.5	100.00	5
20	81 6	1.70	4.75	73.64	282.7	99 98	5
20	74.8	0 65	3.95	85 87	283.7	100 05	5
20	82.0	0.85	3.95	82.29	286 8	100.05	5
20	82.6	0 35	4.15	92.22	285.6	100.00	5
20	81.5	0.20	3.95	95.15	285.2	100.05	5
20	81.4	2.20	4.325	66.28	283.1	100 0	5
20	80.3	0 30	4.55	93.81	282.8	100.0	5
20	82.0	0.20	4 65	95.8	282.8	99 98	5
20	81 1	0 20	4.40	95 7	284.0	100.0	5

Average of 18 trials, involving 98 observations, 99.998.

It is also true that a considerable error in the weight of steam discharged will affect the results but very little, since in every practical case the moisture is a small percentage of the total. Thus, supposing that the results of our examination show 5 per cent. moisture, but that an error in the weight of the steam discharged of 5 per cent. has been made. In that case the correction to our result should be but .05 or one-twentieth of the results obtained, in this case amounting to one-fourth of 1 per cent. The above is an extreme case, and is several times greater than any that is likely to occur, as shown by the results of various tests quoted.

Third, the loss by radiation in the exposed portions of the water glass. This surface is a very small portion of the whole surface, and the loss by radiation is always an exceedingly small amount. We have made a number of experiments in Sibley College to determine this amount, and have considered that in every case it affects the results less than errors of observation. The writer feels that the following conclusions are justified and may in a certain measure serve to guide calorimetry practice. They may be briefly stated as follows:

First, the steam ordinarily discharged from a boiler of proper proportions and in good working condition carries an exceedingly small percentage of water. Second, a certain amount of water will be carried along by the steam in the form of vapor or small drops; that this amount varies somewhat with the velocity, but probably does not exceed two or three per cent. by weight, and furthermore, a fair sample of such steam is usually obtained by any of the ordinary methods in use. Third, water is sometimes thrown from the boiler in large amounts, and in such a case it will usually remain distinct from the steam and pass along the bottom of horizontal pipes in a stream of greater or less depth, and will flow if moving downward in a vertical pipe in irregular positions, depending upon its velocity and various other considerations. Steam carrying water in this way when ascending in a vertical pipe will probably be irregularly charged, and samples drawn from time to time are likely to vary greatly. This condition can usually be considered an abnormal one, and probably cannot be fairly sampled by any method. In case large amounts of water are thrown over, the quality of the steam cannot be even approximately obtained without the use of a steam separator for removing the excess of water. Fourth, steam, even in a very dry condition, is likely to deposit a film of water on the inside of the pipe by condensation. This amount is rarely of sufficient importance to greatly affect the results, but if the calorimeter is so located as to draw this directly into the pipe, it may show very wet steam when the contrary condition actually exists.

The writer believes that samples for calorimetric determination should be drawn from a vertical pipe in which there is an ascending current of steam, and that the sample should be taken as uniformly as possible from all sections of the pipe, except that no steam should be drawn immediately adjacent the exterior portion of the pipe; and in such a case the results will indicate if substantially uniform, in all cases not showing an excessive amount of moisture, *the average quality of the steam within reasonable limits of errors of observation.*

Further, if the determinations obtained by the calorimeter in this position are irregular, or show large percentages of error, it may be reasonably doubted that the sample of steam obtained is accurate.

Fifth, a steam separator is always desirable to remove excess of water from the main steam pipe, in which case determinations should be taken after the steam has passed the separator. The writer, however, believes from his own experience that the use of the separator will not be found essential in one case out of twenty, for the reason that water is very rarely thrown into the steam in larger quantities than the steam itself will take up and retain in a uniformly distributed condition.

Georgia Sunday Freight Train Law Sustained.

The Supreme Court of the United States, in an opinion by Mr. Justice Harlan, delivered May 8, has affirmed the judgment of the Supreme Court of Georgia holding L. F. Hennington, Superintendent of Transportation of the Alabama Great Southern, guilty of violation of the law of Georgia in running a freight train in Dade County, Ga., on Sunday, March 15, 1891. The statute makes the officer in charge of the operating department guilty of a misdemeanor in such a case. The law excepts, under certain conditions, trains carrying live stock and those completing their trips on Sunday night. The defense was that the law was in conflict with the Constitution of the United States, the train being made up of interstate freight. A jury found the defendant guilty and the Supreme Court of Georgia held the statute to be a regulation of internal police, not a regulation of commerce, and

not in conflict with the Constitution of the United States even in the case of an interstate train like this.

Judge Harlan says that if the law had been limited to trains laden with domestic freight there could have been no question, and he goes back to a law of 1762 to show the policy of the State in prohibiting labor on the Sabbath. This old law was re-enacted in 1850. If a statute purporting to protect the public morals is found to have no substantial relation to them, it is the duty of the courts to brush it aside; but no such fault is found in this case. There is nothing in this law to suggest that it was intended to regulate interstate commerce. It is none the less a civil regulation because the day on which the running of freight trains is prohibited is kept by many under a sense of religious duty. The Legislature having, as will not be disputed, power to enact laws to promote the order and to secure the comfort, happiness and health of the people, it was within its discretion to fix the day when all labor, within the limits of the State, works of necessity and charity excepted, should cease. It is not for the judiciary to say that the wrong day was fixed, much less that the Legislature erred when it assumed that the best interests of all required that one day in seven should be kept for the purposes of rest from ordinary labor. The fundamental law of the State committed these matters to the determination of the legislature. If the law-making power errs in such matters, its responsibility is to the electors, and not to the judicial branch of the Government. The whole theory of our Government, Federal and State, is hostile to the idea that questions of legislative authority may depend upon expediency, or upon opinions of judges as to the wisdom or want of wisdom in the enactment of laws under powers clearly conferred upon the legislature. The Legislature of Georgia no doubt acted upon the view that the keeping of one day in seven for rest and relaxation was "of admirable service to a State considered merely as a civil institution." 4 *Bl. Com.* *63. The same view was expressed by Mr. Justice Field in *Ex parte Newman*, 9 *Cal.* 502, 520, 529. The Supreme Court of Ohio is quoted in the same line, and a half dozen other cases are referred to. The Supreme Court of Georgia in the present case said:

> There can be no well-founded doubt of its being a police regulation, considering it merely as ordaining the cessation of ordinary labor and business during one day in every week; for the frequent and total suspension of the toils, care and strain of mind or muscle incident to pursuing an occupation or common employment, is beneficial to every individual, and incidentally to the community at large, the general public. Leisure is no less essential than labor to the well-being of man. Short intervals of leisure at stated periods reduce wear and tear, promote health, favor cleanliness, encourage social intercourse, afford opportunity for introspection and retrospection, and tend in a high degree to expand the thoughts and sympathies of people, enlarge their information, and elevate their morals. They learn how to be, and come to realize that being is quite as important as doing. Without frequent leisure, the process of forming character could only be begun; it could never advance or be completed; people would be mere machines of labor or business—nothing more. If a law which, in essential respects, betters for all the people the conditions, sanitary, social and individual, under which their daily life is carried on, and which contributes to insure for each, even against his own will, his minimum allowance of leisure, cannot be rightfully classed as a police regulation, it would be difficult to imagine any law that could . . . With respect to the selection of the particular day in each week which has been set apart by our statute as the rest day of the people, religious views and feelings may have had a controlling influence. We doubt not that they did have; and it is probable that the same views and feelings had a very powerful influence in dictating the policy of setting apart any day whatever as a day of enforced rest. But neither of these considerations is destructive of the police nature and character of the statute. If good and sufficient police regulations underlie it, and substantial police purposes are involved in its provisions, these reasons and purposes constitute its civil and legal justification, whether they were or not the direct and immediate motives which induced its passage, and have for so long a time kept it in force. Doubtless it is a religious duty to pay debts, but this does not hinder its being exacted as a civil duty.

As to the conflict with the Constitution of the United States, former decisions of the Supreme Court of the United States clearly indicate the true conclusion in the matter. Judge Harlan here quotes Gibbons vs. Ogden, 9 Wheat 1, 203, 210; Wilson vs. Blackbird Creek Marsh Company, 2 Pet., 245, 251, 252; Gilman vs. Philadelphia, 3 Wall, 713, 729; Railroad Company vs. Fuller, 17 Wall, 560; Smith vs. Alabama, 124 U. S., 465, 474, 479, 482, and Nashville, etc., Railway vs. Alabama, 128 U. S., 96, 99, 101. These decisions all deal with the subtleties of conflicts between regulations of interstate commerce and police regulations. The latter are to stand, in spite of the power granted to Congress, only in case they are absolutely necessary, but this question of necessity is to be decided with great care and nicety in every instance. One of the above mentioned cases had to do with a bridge across the Schuylkill River. It obstructed navigation, but "it is for the municipal power to decide whether the commerce under the bridge may not be made subservient to that over the bridge when the latter is much the greater." The first mentioned Alabama decision sustained the right of that State to compel locomotive enginemen to take out licenses, even though employed on interstate trains. Legislation may, in a variety of ways, affect commerce without constituting a regulation of it within the meaning of the constitution. But if Congress had taken action, had prescribed qualifications for locomotive enginemen, then the State law would be superseded if it conflicted with that made by Congress. In the second Alabama case the law of that State prohibiting the employment of color-blind persons on engines was sustained.

In conclusion Justice Harlan says:

> These authorities make it clear that the legislative enactments of the States passed under their admitted police powers, and having a real relation to the domestic peace, order, health and safety of their people, but which, by their necessary operation, affect to some extent, or for a limited time, the conduct of commerce among the states, are yet not invalid by force alone of the grant of power to Congress to regulate such commerce and, if not obnoxious to some other constitutional provision or destructive of some right secured by the fundamental law, are to be respected in the courts of the Union until they are superseded and displaced by some act of Congress passed in execution of the power granted to it by the Constitution. Local laws of the character mentioned have their source in the powers which the States reserved and never surrendered to Congress, of providing for the public health, the public morals and the public safety, and are not, within the meaning of the Constitution, and considered in their own nature, regulations of interstate commerce simply because, for a limited time or to a limited extent, they cover the field occupied by those engaged in such commerce. The statute of Georgia is not directed against interstate commerce. It establishes a rule of civil conduct applicable alike to all freight trains, domestic as well as interstate. It applies to the transportation of interstate freight the same rule precisely that it applies to the transportation of domestic freight. And it places the business of transporting freight in the same category as all other secular business. It simply declares that, on and during the day fixed by law as a day of rest for all the people within the limits of the State from toil and labor incident to their callings, the transportation of freight shall be suspended.
>
> We are of opinion that such a law, although in a limited degree affecting interstate commerce, is not for that reason a needless intrusion upon the domain of Federal jurisdiction, nor strictly a regulation of interstate commerce, but, considered in its own nature, is an ordinary police regulation designed to secure the well-being and to promote the general welfare of the people within the State by which it was established, and, therefore, not invalid by force alone of the Constitution of the United States.

TECHNICAL.

Manufacturing and Business.

A contract for 50,000 rail joints is reported to have been awarded by the receivers of the Baltimore & Ohio to the Continuous Rail Joint Company, of Newark, N. J.

The Paige Journal Box & Boiler Bearing Co., of Chicago, has been incorporated by William E. Paige, Oliver O. Forsyth and James R. Smith.

The New York office of the Brown Hoisting & Conveying Machine Co. has just received an order from the Pennsylvania for a 15-ton bridge crane, of 35-ft. span, for handling heavy freight in the company's Thirty-seventh street yard, New York City.

The roof made by the Ludowici Roofing Tile Company, of Chicago, has been considerably used in the last three years by railroad companies for roofing stations and freight houses. The long life of this roof and the small amount needed to keep it in good repair make it compare favorably as to price in the long run with the common slate roof or even the flat gravel roof generally used on minor railroad buildings.

The cast steel truck bolsters made by the Shickle, Harrison & Howard Iron Co., of St. Louis, have been pscified to go under the dump cars ordered built by the Goodwin Mfg. Co.

The Elliot Frog & Switch Co. announces that its buildings at East St. Louis were little damaged by the tornado and flood of last week, and work was resumed as usual on Monday, June 1.

New Stations and Shops.

The Louisville & Nashville is reported to have agreed to build a union station and train shed at Montgomery, Ala., if the city authorities will grant this company certain concessions. What these are has not been made public and the City Council has postponed action on the matter until the next meeting.

The new stone station of the Lehigh Valley, at Pittston, Pa., has been formally opened. The structure cost about $30,000.

Plans have been completed for a new station to be built by the Illinois Central and the Wabash at Decatur, Ill. It is said that the structure will cost about $100,000.

The Erie is about to begin the erection of a new station at Jamestown, N. Y., at a cost of $20,000. The site will be just west of the present station. The building will be of brick, 120 ft. long.

The New Walker Company.

A new electrical manufacturing company, comprising the old Walker Manufacturing Co., of Cleveland, and two New England Electrical Companies has been formed. Ex-Governor Flower, Anthony N. Brady, J. W. Hinckley, Mr. Belmont, of New York; Dallas Sanders, William Rotch, Parker C. Chandler, Frank Billings and Jacob B. Perkins are interested financially.

The Jungfrau Railroad.

A scientific commission has been formed to study the plans for the Jungfrau Mountain Railroad, and that commission has asked for competitive designs and studies for various parts of the project, the total value of the prizes offered being about $6,000. For complete information regarding this matter one should address Office of the Jungfrau Railroad Company, 10 Bahnhoffstrasse, Zurich. The most important questions to be considered are—

(1) The profile of the tunnel with or without masonry, the superstructure, track, rack system, switches and crossings.

(2) The method of carrying electric power, the power stations, distribution of the power and protection against atmospheric disturbances.

(3) The motor cars and safety apparatus.

(4) The stations in the tunnel.

(5) A lift for a height of about 100 meters, the lift to be about 8 meters in diameter, with staircase to reach to the summit of the mountain.

(6) Piercing the tunnel, its ventilation and measures to be taken for the health and safety of the workmen.

(7) Electric lighting of tunnel, cars and stations, and arrangements for the safety of travelers.

Competitors should submit drawings or models, and should hand in their projects before April 1, 1897. These particulars we get from the *Journal des Transports*.

Cross-Heads.

At a recent meeting of the Southern & Southwestern Railway Club Mr. T. W. Gentry said: "I would like to hear from some of the members on the subject of 'H Cross-heads,' particularly where the wheels have not more than 50 in. center. I hear objections to that form on account of it catching dirt, and wearing faster on the under side." To this Mr. W. H. Hudson answered: "I have not had much experience with them yet, new engines equipped that way have only been running a short while; I find that the cross-heads wear very fast, and that they have to be frequently re-lined in order to keep them in the center. The trouble is that they wear more on the bottom, and the only way is to re-tin them, and bring them up central again. In six weeks we have had three to re-line so far." Mr. W. H. Owens said: "I found on these engines, with 66-in. centers, with 'H' cross-heads, after running for four months the tin lining was worn from the bottom of the cross-heads about one-sixteenth since the engines were built, and we had to re-tin most of them, and the others will soon have to be re-tinned. Our road is ballasted with dirt and gravel, and is not a very dusty road. The idea was advanced by some one that the bottom guide did not get as much lubrication as the top. I think there is nothing in that, as we have oil cups for the bottom guides the same as those on the top. The trouble is evidently dust collecting on the bottom guide." Mr. E. M. Roberts said: "I am sorry there is not some one here who has a rock-ballasted road. It might be interesting to add, that these 'H' cross-heads are the standard for the Pennsylvania Railroad, and have been for a number of years. Their road is ballasted with stone, and I suppose these cross heads are satisfactory, as they continue to use them. I think the difficulty is entirely owing to the sand in this section of the country."

Electric Power Plant at the Lachine Rapids.

For some time past work has been carried on by the Lachine Rapids Hydraulic Co. upon a large wing dam which runs out for more than 1,000 ft. into the St. Lawrence River. A fall of water is secured by means of this dam, sufficient to develop at the low water season 15,000 H. P. This water power is to be transformed into electricity. A power house 1,000 ft. long will be built upon the dam, the basement of which will be occupied by the water wheels from the Stilwell-Bierce, Smith-Vaile Works at Dayton, O. The main floor will contain twelve 1,000 H. P. dynamos of the General Electric Company's latest multiphase type, and will generate current for transmission to Montreal for use there in lighting the city and operating the street railroads. The contract for this electrical installation is one of the largest ever placed at one time for electric dynamos, and it was competed for by many prominent electrical manufacturers all over the world.

Engineering Instruments for Sale.

The Atchison, Topeka & Santa Fe Railway is offering for sale a number of engineering instruments that have been accumulating, presumably since the first surveys for the road. There are 52 levels and 46 transits of a variety of makes and in good, fair and bad condition. There are also about 125 level rods, flag poles, sight rods, etc., nearly 100 surveyors' chains, pins, etc. The list is concluded with 7 blue printing frames, 24 drafting tables and an engineer's folding field desk.

Compound Locomotive Trials on the Paris, Lyons & Mediterranean Railroad.

It is well known that the Paris, Lyons & Mediterranean has adopted the compound locomotive to a great extent both for passenger and freight traffic, and that the experiments which have been there made with this type of engine have been very thorough and elaborate. In a recent issue of the *Revue Générale des Chemins de fer*, M. Privat gives an account of a series of experiments that were not yet ended, with the latest high speed compound locomotives on that line. The locomotive tested was the first of a lot of 40 built according to the designs of M. Ch. Baudry, Superintendent of Motive Power and Rolling Stock. In the *Railroad Gazette* for Nov. 22, 1895, we illustrated these locomotives. In the tests the amount of water consumed is measured rather than the fuel, as this method removes the trial from the domain of the fireman and places the locomotive record on the basis of relative steam consumed. The engineers in charge of the work have plotted certain diagrams of steam consumption which show, within the limits through which the experiments were conducted, that the consumption of steam per indicated horse power increases slightly when the cut-off in the high-pressure cylinders remains the same, that of the low-pressure is made later, while the consumption of steam per effective horse power diminishes. They, therefore, con-

clude that the engineer should not have it in his power to adjust the ratios of the points of cut-off between the high and low-pressure cylinders, and that this point of cut-off should be so adjusted that, for the low-pressure cylinders, it should stand pretty constantly at seven-tenths of the stroke. Hence the reversing gear of all the high-speed compound locomotives owned by the Paris, Lyons & Mediterranean have been modified to meet this requirement.

Coupler Tests.

The Whiteley Malleable Castings Co., of Muncie, Ind. sends us a special report made by Mr. Charles Dunn, representative of R. W. Hunt & Co., of Chicago, of a test made on 14 malleable-iron, American couplers. These were selected from a lot of 1,000 ready for shipment. The last six couplers were not destroyed owing to the fact that the representative did not have time to devote to it.

1.	3 blows at	10	ft.	9 blows at	15	ft.	Bar broke in shank.
2.	3 "	10	"	6 "	10	"	Knuckle broke, bar cracked in head.
3.	3 "	10	"	8 "	15	"	Knuckle broke, bar bent in shank, but solid.
4.	3 "	10	"	9 "	15	"	Stem cracked.
5.	3 "	10	"	4 "	15	"	Knuckle broke at third blow, bar broke in shank at fourth blow.
6.	3 "	10	"	9 "	15	"	Bar broke in shank.
7.	3 "	10	"	8 "	15	"	Knuckle broke, bar solid.
8.	3 "	10	"	6 "	15	"	Knuckle broke, bar cracked at back of head
9.	3 "	10	"	4 "	15	"	Bar and knuckle O. K.
10	3 "	10	"	3 "	15	"	"
11.	3 "	10	"	3 "	15	"	"
12.	3 "	10	"	3 "	15	"	"
13.	3 "	10	"	3 "	15	"	"
14.	3 "	10	"	3 "	15	"	"

The last six bars tested were not broken. The inspector said he had to hit them too many times to break them and he could not spare the time. He thought they would all average seven or eight blows, as none of them cracked.

Annual Meeting of the Niagara Falls Power Co.

At the annual meeting of the Niagara Falls Power Company, held at Niagara Falls on June 1, the following directors were elected: President, Dr Coleman Sellers, of Philadelphia; First Vice-President, Gen. Benjamin Flagler, of Niagara Falls; Second Vice President, Charles A. Sweet, of Buffalo; Treasurer, E. S. Wheeler, of Niagara Falls.

Secretary Rankine said that the contract with E. D. Smith & Co. for the extension of the wheel pit to accommodate seven more 5,000 H. P. dynamos was formally authorized, and work will begin soon. The new cut will extend quite a distance south along the canal.

THE SCRAP HEAP.

Notes.

A fire at Fort Worth, Tex., May 25, destroyed, among other buildings, the Union Railroad station. From remarks in the newspapers of Texas we conclude that some of the other cities in the state would look upon it as a blessing if they could have something of the kind happen to their Union stations.

A "cloudburst," making a great flood, did great damage at Seneca, Mo., on May 30, about 7 p. m., wrecking 25 buildings and causing the death of 27 persons. Two bridges on the St. Louis & San Francisco were carried away. At Mound City, Mo., on May 31, there was a disastrous flood, in which a bridge 60 ft. long was destroyed.

One of the men arrested for derailing a passenger train on the Southern Railway near Macon, Ga., Feb. 29, has been convicted. It will be remembered that in this case (in which a passenger train fell through a trestle, and before a flag could be sent out, a freight was wrecked at the same point) two men were accused of loosening a rail for the purpose of killing their own wives, both of which women were on the train.

A law has been passed in Massachusetts, to go into effect June 9, which will facilitate the punishment of tramps for riding on freight trains. It applies, we believe, to all persons of 17 years of age or older, and provides that riding on the freight train of any railroad, whether within or without, any car or part thereof, without a permit from the proper officers or employees of such railroad or train, shall be *prima facie* evidence that such person is a tramp.

For five years the Baltimore & Ohio has been compelled every summer to haul water in tanks from the Ohio River to supply its locomotives on the division through West Virginia, where the mountain streams give out very quickly in dry weather. To avoid this a reservoir with a capacity of 3,000,000 gals. is building at Glover's Gap, W. Va. The water will be furnished by artesian wells, several of which have been drilled in the vicinity. On the Pittsburgh Division, near Triadelphia, a similar reservoir, but smaller, is being built for the same purpose.

Efficiency of Animal Traction.

Regarding the efficiency of animal traction extensive experiments have been made by Professor Pfuhl, of Riga, Russia, whereby he found the power of the combined pull of several animals (horses, mules, oxen) on the same load to decrease as follows. The traction effort of one animal is called 100:

Pull of one	animal		100
" two	"		195
" three	"		261
" four	"		320
" five	"		356
" six	"		402
" seven	"		385
" eight	"		384

Scholarships in the Worcester Polytechnic Institute.

By recent enactment of the State Legislature of Massachusetts, 20 new free scholarships become available in the Worcester Polytechnic Institute to the next entering class. This makes 40 free scholarships in all available, being one for every Senatorial District in the State, in addition to the 25 or 30 free scholarships to which students from Worcester County only are eligible.

The Railway Benevolent Institution.

Our English exchanges give some report of the 38th annual dinner of the Railway Benevolent Institution which took place lately in London, and from the reports we gather a few interesting facts. Among the objects of the Institution the most important is the provision of annuities to railroad officers and servants permanently incapacitated by old age, disease or accident; also to widows of railroad men. The Institution educates and supports orphan children and men who have been connected with the railroad service. The total number now interested in the institution is 121,000. The number of annuitants is 918 and the number of orphans benefited up to the present time 651, and there are now 317 orphans under the care of the Institution. The number of persons relieved by the casualty funds last year was 113,404. The total number relieved in five years was 528,994.

The Careless Passenger and the Elevated Railroad.

One day recently a gentleman who had gone up town on a train of the Sixth Avenue Elevated, New York, discovered that he had lost his pocketbook, in which was nearly $100 in currency, as well as some cards giving his name and address. A day later he was notified that his pocketbook could be had, on identification, at the lost property room of the Manhattan Elevated. He went there and found the pocketbook with its contents complete. It had slipped out of his pocket and had been picked up from the seat by a guard and sent to the lost property room. It may not be out of place to say that this guard is Frank Brampton. We shall not stop to write a sermon on the origin and development of morals, but suggest that a system that produces such a result as this is pretty efficient in selection and in discipline.

Testing Armor Plate.

A second test of the plates for the battleship Iowa was made by the Bethlehem Iron Co. last week at Redington. The plate was Harveyized, 9 ft. × 17 ft., 15 in. thick, and weighed 38 tons. A 500-lb. Carpenter projectile was fired at it from a 10-in. gun at a velocity of 1,940 ft. per second. It penetrated the plate to a depth of a few inches and then was shattered to pieces. The test resulted in the acceptance of 500 tons of armor. The first test was made about three weeks ago, but the plate was defective, and another test was necessary.

LOCOMOTIVE BUILDING.

The Baltimore & Ohio has awarded the contract for 10 freight locomotives to the Cooke Locomotive and Machine Works, of Paterson, N. J. The engines are to be of the consolidation type, with 58-in. driving wheels and 22-in. × 23-in. cylinders.

Some description of the 25 consolidation engines for general freight service, recently contracted for with the Richmond Locomotive Works by the Baltimore & Ohio, is given below:

Size of cylinders	21 in. × 26 in.
Size of drivers	50 in.
Size of truck wheels	30 in.
Size of driving axle journals	7½ in. × 8 in.
Size of truck journals	5 in. × 8¾ in.
Total wheel base	23 ft. 2 in.
Driving wheel base	15 ft. 2 in.
Width, out to out of frames	51 in.
Total weight in working order	134,000 lbs.
Weight on drivers	121,000 lbs.
Heating surface—Tubes	1,766.08 sq. ft.
" " Firebox	201.26 sq. ft.
" " Total	1,967.34 sq. ft.
Grate area	28.65 sq. ft.
Boiler—Wagon top: Diameter, front ring	60 in.
Crown sheet supported by crown bars.	
Diameter of tubes	2¼ in.
Length of tubes	13 ft. 8 in.
Number of tubes	222
Tubes spaced	¾ in. apart
Height from grate to lowest tube	31 in.
Water space, sides and back	3 in.
" " front	4 in.
Size of firebox	34⅜ in. × 120 in.
Boiler pressure	165 lbs.
Boilers lagged with	Asbestos
Longitudinal seams, butt joints with double-cover strips.	
Brick arch	Supported by studs or tubes
Grate bars	Rocking bar type
Crossheads	Cast steel or wrought iron—two-bar type
Parallel rods	With brass bushings
Driving boxes	Cast iron with crown bearings
Piston	Cast iron
Tender.	
Size of tank	3,500 gals.
Thickness of sheets—top, inside and bottom	⅜ in.
" " " outside plates	¼ in.
Tender frame	Built of oak
Tender truck, diamond type: Diameter of wheels	33 in.
" " " Size of journals	4¼ in. × 8 in.

BRIDGE BUILDING.

Ashbury Park, N. J.—The Berlin Iron Bridge Co. has been awarded the contract for building a new bridge over Deal Lake for $24,990.

Bedford, Pa.—The County Commissioners have awarded the contracts for four steel bridges to the West Virginia Bridge Works for $1,555. The bridges are over Clear Creek in West Providence township, Brushy Forks near Chaneysville, Sulphur Springs in Harrison township and at Pleasantville.

Canton, Pa.—Contractor Whalen, of Towanda, has been awarded the contract for building the new stone bridge for the Northern Central Railroad, near Union street.

Fairmont, W. Va.—The contract for the highway bridge over a ravine from Fairmont to West Fairmont was let last week to W. B. Dickerson, a local contractor, for $12,000.

Glassport, Pa.—It is said that a new bridge will be built across the Monongahela to connect the towns of Mendelssohn and Glassport. The preliminary surveys have been made and the estimated cost is $175,000. The bridge will have two floors, one for railroads and the other for a highway.

Harrisburgh, Pa.—Bids were received by the County Commissioners for the masonry for the new bridge over the canal at Franklin street, as follows: George Hynicka, $1,900; Koppenheffer & Co., $1,865; Hiram Chubb, $1,773; J. W. Hocker, $1,993; Henry Opperman, $1,808; George S. Mish, $1,272. All the bidders are from Harrisburgh.

Houston, Tex.—The New Columbus Bridge Co., which was awarded the contract for building the Hill street bridge, has sublet the work to the Indiana Bridge Co., according to reports.

Indiana, Pa.—Michael Bennett has been awarded the contract for the substructure of the Graceton bridge for $2.32 per cu. yd., and Neil & Drummond, of Trade City, the contract for the substructure of the bridge in South Mahoning for $2.60 per cu. yd.

Ironwood, Mich.—It is said that the Town Council has agreed with the Hurley Town Board to build an iron bridge of 36-ft. span over the Montreal River in place of the wooden bridge which was recently washed away.

Lewiston, Me.—The contract for the bridge over the Androscoggin River has been awarded to the Youngstown (O.) Bridge Co., for $146,000. The bridge will be built of steel and will be 643 ft. long.

London, Ont.—The Southwold Township Council has decided to erect two new steel bridges at Payne's Mills and at the Danbury Bridge.

Long Branch, N. J.—Press reports state that the Monmouth County Board of Freeholders has awarded the contract to Dean & Westbrook, of New York, for building a plate girder bridge with a concrete and vitrified brick flooring, for $6,719.

McKeesport, Pa.—The Second Avenue Traction Co. has given Harrold & Campbell, of Beaver Falls, the contract for a bridge at Suterville, which will be 800 ft. long, with two abutments and three piers, to span the Youghiogheny River. The stone work has been commenced.

Miami, Fla.—The Florida East Coast Railway Co. proposes to build a 250-ft. steel girder drawbridge across the Miami River at Miami. The bridge will be a joint highway and railroad bridge.

Milwaukee, Wis.—According to press reports the City Engineer has been directed to prepare estimates for a bridge to Jones Island.

The following bids were received May 21 for building the substructure of a drawbridge at Huron street: David Turner, $20,989; T. F. Kelly, $26,400; J. Markey, $26,980; A. F. Dues, $27,600, the bidders all being from Milwaukee. The contractors for the superstructure were The H. M. R. Construction Co., Chicago, $24,360; Milwaukee Bridge Co., $23,480; Wisconsin Bridge & Iron Co., Milwaukee, $27,950 to $29,450.

New Bedford, Mass.—According to reports plans have been completed for the new bridge, and work will probably be begun about July 1.

New Westminster, B. C.—The city is negotiating with private capitalists to undertake the building of the bridge across the Frazier River. Aid had been asked from the government for this purpose, but it was refused.

New York.—The stockholders of the New York & New Jersey Bridge Co. met last Tuesday to elect a new Board of Directors. The following were elected: Gen. James S. Clarkson, Des Moines, Ia.; William J. Latta, Philadelphia, Pa.; John S. Runnells, General Counsel Pullman Co., Chicago, Ill.; Hon. Daniel N. Lockwood, Buffalo, N. Y.; Louis Windmuller, Frederick Potter, Charles A. Smylie, William Bell, William H. Ely, New York; Lorenzo Duncan, Brooklyn, N.Y.; John Loughran, President Manufacturers' Bank, Brooklyn, N. Y.; Chas. H. Swan, Brooklyn, N. Y.; John C. Adams, President Consumers Gas Co. Newburgh, N. Y. Secretary Swan said: "A plan for raising the money for construction is under the consideration of representative men, and they are arranging to form the syndicate for the advantageous negotiation of the bonds; but it is deemed best to await an improvement in the financial condition of the country before completing any definite financial operations."

Niagara Falls, N. Y.—The work of excavation for the anchor pits for the cables which are to act as supports during the construction of the arch bridge has been begun.

North Amherst, Mass.—Press reports state that the R. F. Hawkins Iron Works, of Springfield, Mass., has been awarded the contract for a new iron bridge.

Olivet, S. D.—It is stated that bids will be received until July 1 for building a pile bridge. Paul Dekker is County Auditor.

Paxton, Ill.—Bids will be received till June 16 for constructing a 100-ft. span highway bridge. Samuel Ludlow is the Town Clerk.

Portland, Me.—It is reported that the Groton (N. Y.) Bridge Co. has been awarded the contract for building a bridge of 65 ft. span over Martin's Stream to replace the present structure.

Richmond, Ind.—Bids were received as follows, May 18, for building a steel bridge 635 ft. long: Variety Iron Works, Cleveland, O., $60,780 and $76,900; D. L. Blair & Co., Indianapolis, Ind., $63,000 and $80,000; Wabash (Ind.) Bridge Co., $59,000 and $79,995; King Bridge Co., Cleveland, O., $58,600 and $79,000; Youngstown (O.) Bridge Co., $58,100 and $77,500; Penn Bridge Co., Beaver Falls, Pa., $61,000 and $76,500; Bellefontaine (O.) Bridge Co., $63,000 and $80,000; Wrought Iron Bridge Co., Canton, O., $57,530 and $77,500; Toledo (O.) Bridge Co., $56,890 to $80,700; Canton (O.) Bridge Co., $65,779 and $79,833; Morris & Wait, Chicago, Ill., $50,758 to $61,886; Massillon (O.) Bridge Co., $53,314 to $78,641. This last company was awarded the contract. The bids were for two kinds of flooring, a solid floor of buckle plate concrete and brick or asphalt and also for an ordinary plank floor.

St. Louis, Mo.—A change has been made in the bridge bill, the limiting distance from the two other structures being reduced from five-eighths to one-half a mile. The projectors would not accept the bill with the five-eighths mile clause, on the ground that that would put the bridge out of the line of traffic. They will, however, probably accept it now. The bridge must be begun in one year and finished in five.

Scranton, Pa.—The City Engineer will make a survey at Lackawanna avenue to ascertain the most feasible route for a viaduct over the tracks of the Delaware, Lackawanna & Western Railroad.

South Bethlehem, Pa.—A petition has been sent to the Northampton and Lehigh County courts asking for the erection of a bridge across the Lehigh River from the Main street canal bridge to Third street and Brodhead avenue.

Tacoma, Wash.—The Advisory Board of the Wheelmen's Association has decided to build a bridge from Tacoma avenue across to the reservoir. Plans and specifications may be seen at the City Engineer's office

Tamaqua, Pa.—The old wooden bridge of the Central Railroad of New Jersey known as "High Bridge" is to be taken down and replaced by a new steel one. The bridge was built in 1867 by the Nesquehoning Valley Co. and is 1,030 ft. long. It is reported that the Phœnix Bridge Co. has been awarded the contract for the work

Titusville, Pa.—The County Commissioners have awarded the contract for building a 125-ft. span bridge over the Little Oil Creek at Holiday's Dam to the Massillon (O.) Bridge Co., and one to the Canton (O.) Bridge Co. for a 60 ft. span over Little Oil Creek at Hyde Park. The contract for the substructure of the Holiday's Dam bridge has been awarded to Edward Allen.

Washington, D. C.—The Senate on May 29 passed the bill authorizing the Braddock & Duquesne Railroad Company to bridge the Monongahela River from Braddock to a point opposite in Mifflin Township.

Wilkes-Barre, Pa.—The Wilkes-Barre & Wyoming Valley Traction Co. has awarded the contract for a steel bridge to be built over the tracks of the Lehigh Valley and Jersey Central railroads to the Pennsylvania Steel Co. Joseph Hendler has been awarded the contract for the masonry.

Windsor, Vt.—F. O. Sinclair, of Burlington, Vt., has been awarded the contract for constructing an 85-ft. span highway bridge at Windsor.

RAILROAD LAW—NOTES OF DECISIONS.

Injuries to Passengers, Employees and Strangers.

In Texas it is held by the Supreme Court that the station having been called, and reasonable time given for alighting, a carrier is not liable for taking a passenger by her station, though the conductor had promised to specially notify her and assist her from the train.[1]

In Texas it is held that where a rule of a railroad prohibits persons riding on the engines, a person riding on a switch engine at the invitation of the engineer, who is aware that the engine is not intended for the carriage of passengers, cannot hold the company liable for injuries to him as a passenger.[2]

The Supreme Court of Louisiana rules that a passenger on a train in motion, who attempted to pass from one car to another, and in doing so was thrown from the platform by a sudden jerk of the train, could not recover, though the coupling between the cars was defective.[3]

In Texas it is ruled that a railroad is liable for the act of its conductor in carrying a passenger, who was traveling at night, beyond the point where he had agreed to put such passenger off, in consequence of which the latter, while attempting to find the road which led to a friend's house, fell into a ditch, and was injured, without fault on his part.[4]

The Supreme Court of Kentucky decides that though it is as times unwarrantable to require railroad companies to keep the depot platforms clear of ice and sleet, where, in an action for injuries received while alighting from a passenger train, caused by ice on the platform, there is proof as to the condition of the platform and of the weather, and the question is fairly submitted to the jury, the Supreme Court will not disturb the finding.[5]

In Indiana a jury found that deceased was a section hand employed on defendant's tracks; that as the time given for dinner was short he and his co-employees had long been in the habit of eating their dinners in a pump house in the vicinity, belonging to defendant; that they so used the pump house by authority of their foreman, on the invitation of the person in charge of the house, and without objection on defendant's part; that deceased, while so eating his dinner, was killed by the explosion of a defective boiler. The Supreme Court holds that such verdict does not sustain a judgment against defendant, because of failure to find that deceased was in the house in the line of his duty, by the invitation of defendant.[6]

In Michigan the Supreme Court rules that a brakeman injured by the breaking of a pushbar on an engine when he attempted to make a coupling, while standing on the crossbar of the engine, who had ridden on the pilot for two miles before reaching the car to which the coupling was to be made, was not guilty of contributory negligence; it being necessary, in any event, that he should get on the crossbar to make the coupling.[7]

In Kentucky it is laid down that in an action by a brakeman against a railroad company for injury to his fingers while coupling cars, through the gross negligence of defendant's employees, defendant cannot show that brakemen frequently get their hands or fingers injured in coupling cars.[8]

In Pennsylvania it is held that a freight brakeman injured by falling from a car cannot hold the company liable on the ground that the car was not provided with grab irons and hand holds on the end of the car sufficient to prevent his fall, if there were steps, for the use of brakemen, so constructed as to answer the purpose of grab irons or hand holds as well as of steps, and such cars were in common use and were sufficient if used with ordinary care.[9]

In Indiana in constructing a railroad bridge the workmen laid thick plank as a track on which to move bridge timbers. They inserted wedges under the thinner ends. In the use of the track, such wedges would work out, and, if displaced, could easily be seen by one looking at the joints, and replaced. Such method of moving timbers was the usual one. One of such wedges worked out, and while the workmen were moving a timber on the track over the joint it tipped and fell, knocking one of the workmen off the bridge. The Supreme Court rules that the foreman was not a vice principal, since the duty of keeping the wedges in place was not devolved on the master.[10]

The Court of Appeals of Colorado decides that in an action by a brakeman against a railroad for injuries from the derailing of an engine by a rock on the track, where it appeared that defendant's road ran through a rocky gorge, subject to rock falls, and that two months prior to the accident blasting, to widen the road, had been done, since which time, up to the accident, trains had been safely run, and there was no evidence as to how the rock got on the track, except that there was a hole in the bluff, 12 or 15 ft. from the roadbed, about the size of the rock, which was inspected only from the track, it was error to refuse a nonsuit.[11]

In Indiana it is ruled that where so brief an interval is allowed a railroad section hand in which to eat his dinner that he cannot leave the premises for that purpose, the act of eating at the place where he is working is incidental to the service, and the relation of master and servant continues during the interval.[12]

In Texas plaintiff's husband was an employee of a coal company, and was engaged in loading coal from an elevated platform, through a chute, to a car on defendant's tracks. The chute was so applied to the car that any abrupt movement of the latter would injure it. Defendant caused a "flying switch" to be made, with great speed, from the main track to the side track upon which the car was being loaded. Plaintiff's husband, whose duty it was to protect the chute, not appreciating the speed of the approaching cars, climbed on an intervening box car to set the brakes and intercept the collision with the coal car, and was thrown down by the collision and killed. The Supreme Court holds that plaintiff was not prevented from recovering on the ground that he was a volunteer.[13]

In Texas it is held that where a rule of a railroad has been for a long time habitually and openly disregarded by the employees, and the company has made no attempt to enforce it, the mere non-observance of the rule by an employee will not, in case of injury, constitute contributory negligence.[14]

In Michigan it is held that where a railroad makes no provision for inspection of locomotives except by engineers, and an accident occurs to a brakeman from a defective pushbar on an engine known to the engineer before starting on the trip, it is a question for the jury whether the engineer does not occupy such relation to the company that notice to him is notice to the company.[15]

The Supreme Court of Michigan holds that in an action by a brakeman for injuries received in coupling cars, alleged to have been due to the defective condition of the draft irons on the car, the mere evidence that the draft irons were out of order after the accident is not sufficient to show that they were so out of order when the cars were inspected, where there is evidence that at the time of the coupling the cars came together with sufficient force to have caused the defect.[16]

In Montana it is ruled that where an act of a brakeman in mounting a car was not per se negligent, it is competent to show that, under the same circumstances, experienced brakemen perform the same act as he did.[17]

In a case in the Supreme Court of the United States, a car repairer in defendant's employ was killed while at work under a car, through the backing against it of a caboose attached to an engine. An "air adjuster," who was watching by the track, called to the switchman, who was in charge of the movements of the caboose, when it was about 30 ft. away, directing him not to allow the coupling to be made, as men were at work under the car. The Supreme Court rules that the fact that the switchman made some reply, not understood by the witnesses, did not show that he heard and understood the call of the car repairer, so as to have been guilty of negligence in allowing the caboose to thereafter strike the car.[18]

In Georgia it is held that violation of a rule of defendant company prohibiting the use of intoxicating liquors by its employees did not preclude a recovery for the death of an employee, where it did not contribute in an appreciable degree to the death.[19]

In Illinois the evidence showed that, while plaintiff was holding his team of horses near the railroad track, an engine came along and scared the horses by blowing off steam and whistling, and that as the engine approached the place on a perfectly straight track the engineer was leaning out of the cab window. The Supreme Court holds that the evidence warranted an instruction basing defendant's liability on the hypothesis that the engineer saw plaintiff, and then negligently or wantonly whistled and blew off steam.[20]

In Michigan it is held to be negligence to run a train between a station and a train opposite it, engaged in discharging and receiving passengers, express and mail, it being necessary for passengers and persons whose business it is to receive the express and mail to cross the intervening track.[21]

The Supreme Court of Georgia decides that one who helped a passenger on a train, and was injured in stepping from the train before it left the station, because of a sudden jerk of the car as he was about to step therefrom, was not guilty of negligence, as a matter of law, where he helped the passenger on the train with the conductor's knowledge, and the train started without warning, contrary to custom, and at the time of the accident was moving but three miles an hour.[22]

In North Carolina the Supreme Court rules that where an engineer, by the exercise of ordinary care, can see that a human being is lying apparently helpless on the track in front of his engine, in time to stop the train without peril to the persons on the train, the company is liable for any injury resulting from his failure to perform his duty, notwithstanding the previous negligence of the person injured.[23]

In Kentucky it is held that railroad companies are liable for injuries to persons rightfully on its depot platform, who are struck by a mail pouch thrown from a rapidly moving train.[24]

[1] St. L. S. W. v. McCullough, 33 S. W. Rep., 385.
[2] Wilcox v. S. A. & A. P., 33 S. W. Rep., 379.
[3] Bemiss v. N. O., 18 South. Rep., 711.
[4] H. & T. C. v. Smith, 32 S. W. Rep., 710.
[5] L. & N. v. Cockerel, 33 S. W. Rep., 407.
[6] C., C., C. & St. L., v. Martin, 41 N. E. Rep., 1051.
[7] McDonald v. Mich. Cent., 65 N. W. Rep., 597.
[8] Cin., N. O. & T. P. v. Lewallen, 32 S. W. Rep., 958.
[9] Dooner v. D. & H. C. Co., 33 A. D. Rep., 415.
[10] Bedford Belt v. Brown, 41 N. E. Rep., 359.
[11] D. & R. G. v. McComas, 42 Pac. Rep., 676
[12] C., C. C. & St. L., v. Martin, 41 N. E. Rep., 1051.
[13] W., M. W. & N. W. v. Duncan, 32 S. W. Rep., 878.
[14] T. & P. v. Leighty, 32 S. W. Rep., 799.
[15] McDonald v. Mich. Cent., 65 N. W. Rep., 597.
[16] Perry v. Mich. Cent., 65 N. W. Rep., 606.
[17] Prosser v. Mont. Cent., 43 Pac. Rep., 81.
[18] Southern Pac. v. Pool, 16 S. Ct., 338
[19] W. & A. v. Bussey, 23 S. E. Rep., 207.
[20] C., B. & Q. v. Youtz, 42 N. E. Rep., 61.
[21] Tubbs v. Mich. Cent., 61 N. W. Rep., 1161.
[22] Suber v. G., C. & N., 23 S. E. Rep., 3-7.
[23] Pickett v. W. & R., 23 S. E. Rep., 261.
[24] Williams v. L. & N., 32 S. W. Rep., 934.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, quarterly, $2 per share, payable June 6.

Delaware & Hudson Canal, quarterly, 1¾ per cent., payable June 15.

Maine Central, quarterly, 1½ per cent., payable July 1.

Philadelphia, Wilmington & Baltimore, semi-annual, 3 per cent., payable July 1

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Boston & Lowell, special, Passenger Station in Boston, June 10.

Calgary & Edmonton, special, Windsor Hotel, Montreal, Que., June 10.

Chicago, St. Paul, Minneapolis & Omaha, annual, company's office, Hudson, Wis., June 6.

Duluth & Iron Range, annual, company's office, Duluth, Minn., June 8.

Northern Railroad of New Jersey, annual, company's office, Englewood, N. J., June 17.

Accountants' Association.

The Association of American Railway Accounting Officers held its eighth annual meeting in New York City, May 27. The officers chosen for the ensuing year are: President, Erastus Young (U. P.); First Vice-President, H. M. Kochersperger (N. Y., N. H. & H.); Second Vice-president, Carlton Hillyer (Georgia R. R.); Secretary, C. G. Phillips, 355 Dearborn street, Chicago.

National Association of Local Freight Agents' Associations.

The ninth annual convention of this association will be held at the Tremont House, Chicago, on Tuesday, June 9. Some of the topics for discussion are: "Seniority in Making Promotions," "Proposed Code of Definitions of Traffic Terms Used in Railway Accounting," "Should Yard Clerks be Under the Control of Agent or Yardmaster?" "Should Car Service be Collected by the Car Service Association or by the Local Agents?" "Is it Profitable or Desirable to Handle Cars of Mixed Shipments between Factories, Warehouses and Freight Depots?" "What is the Best System of Checking and Loading Freight and Noting Discrepancies, Locating Cases of Wrong Loading and Overs and Shorts?"

The Secretary of the association is Jas. V. Braden, Wheeling, W. Va.

PERSONAL.

—Mr. J. E. Hannegan has been appointed Assistant General Passenger Agent of the Cleveland, Akron & Columbus, with office at Cleveland, O.

—Mr. H. S. Martin has resigned as Purchasing Agent of the Pennsylvania Steel Co., to take the position of Assistant to President Felton, of that company.

—Receivers John K. Cowen and Oscar G. Murray, of the Baltimore & Ohio, have been allowed by the United States Court $2,300 a month each as salary.

—Gen. R. F. Hoke, President of the Georgia, Carolina & Northern, has been elected President of the North Carolina Car Co., succeeding Mr. Julius Lewis, of Raleigh.

—Mr. S. M. Prevost, General Manager of the Pennsylvania, who has been spending the past two months in Europe, was a passenger on the steamship Paris, which arrived in New York Monday of this week.

—Mr. Gilbert Harris, Passenger and Ticket Agent of the Chicago, Burlington & Quincy at Kansas City, for the last three years, has resigned to engage in other business. He has been with this railroad company nearly 18 years.

—Mr. H. A. Boomer, who was formerly Division Superintendent of the Toledo, St. Louis & Kansas City road at Frankfort, Ind., is now Superintendent of the Peoria Division of the Lake Erie & Western, with headquarters at Lafayette, Ind. In the latter office he succeeds Mr. S. R. Kramer.

—Mr. E. A. Robbins, Division Superintendent of the Columbus, Hocking Valley & Toledo, has resigned. Mr. Robbins has been Superintendent of the Toledo Division for a number of years. On his retirement that division will be merged with one of the other two divisions of the company.

—Mr. C. W. Cecil has been appointed Southwestern Agent of the Georgia & Alabama, with headquarters at No. 640 Gravier street, New Orleans. Mr. Cecil was formerly Soliciting Passenger Agent of the Southern Railway at Richmond, Va., and previously was with the Queen & Crescent.

—Mr. Allen Sarle, General Manager of the London, Brighton & South Coast Railway, was knighted by Queen Victoria on her recent birthday. Sir Allen Sarle is 68 years old and has been in the railroad service 51 years. His first service on the Brighton road, as Auditor of Accounts, began in 1849. He became General Manager in 1886.

—Mr. W. E. Looney, Master Car Builder of the Louisville, Evansville & St. Louis, has resigned that office. The car building department will hereafter be under the direction of the Master Mechanic, Mr. J. S. Sechler. The Master Mechanic has also been placed in charge of the store keeping department, and the office of General Storekeeper has been abolished.

—Mr. H. M. Yerington, General Superintendent of the Virginia & Truckee and Carson & Colorado roads in Nevada, is reported to have resigned, intending to leave this country for an extended tour in Europe. Mr. R. J. Laws, Assistant General Superintendent and Chief Engineer of the Carson & Colorado road, is reported to have succeeded Mr. Yerington as General Superintendent.

—Mr. E. O. Man has been appointed Division Superintendent of the Missouri Pacific to succeed William Caughlin, who recently went to the St. Louis Southwestern. L. H. Luke, at present chief train despatcher of the Central Branch, has been appointed Division Superintendent of the Central Branch, to succeed Mr. Man, whose headquarters will be transferred from Concordia to Atchison, Kan.

—Mr. H. J. Rhein has been appointed General Agent of the Lake Shore & Michigan Southern at Detroit, Mich. He has been recently in the freight department of the Big Four road at Detroit, and formerly was with the Michigan Passenger Agent of the Cincinnati, Hamilton & Dayton. The office to which Mr. Rhein is now appointed is a new one, and made necessary by the new formation of a Detroit and Cincinnati passenger route over the Lake Shore and the Big Four lines.

—Mr. William H. Joyce, General Freight Agent of the Pennsylvania road, sailed from New York last week for Europe where he expects to spend several months. Just before leaving Philadelphia Mr. Joyce was entertained at dinner by Mr. Frank Thomson, First Vice-President of the Pennsylvania, at his country house at Merion, Pa. The guests were all railroad men and besides officers of the Pennsylvania included the members of the Board of Managers of the Joint Traffic Association.

—Mr. F. W. Fratt, General Manager of the Sherman, Shreveport & Southern, a Texas road controlled by the Missouri, Kansas & Texas, has resigned. The office will be abolished, and the operation of the road placed in charge of Mr. E. M. Alvord, General Superintendent. Mr. Fratt has been General Manager since 1893. He was previously Chief Engineer of the Texas lines of the Missouri, Kansas & Texas, then being extended and con-

nected. He was Chief Engineer of the Wisconsin Central before the lease to the Northern Pacific.

—Mr. I. N. Kalbaugh was recently promoted from the office of Division Master Mechanic of the Baltimore & Ohio and Master Mechanic of the Pittsburgh & Western, to be Superintendent of Motive Power of the Baltimore & Ohio lines east of the Ohio River. Last Saturday he visited Pittsburgh and the Glenwood shops where he was located about eleven years, and in the evening was presented with a gold watch, chain and a charm set with diamonds, and a diamond breast pin for his wife, about one hundred of the men being present. Mr. Kalbaugh made an appropriate response.

—Mr. Edward Foley, Foreign Freight Agent of the Erie, has resigned, and was succeeded on June 1 by Mr. C. P. Lamprey, with headquarters at No. 216 Produce Exchange, New York City. Mr. Lamprey began his career in 1881 as a clerk with the New England at Boston. From 1883 to 1890 he was successively Traveling Agent, Commercial Agent and State Agent of the West Shore at Syracuse. In 1890 he was appointed Traveling Freight Agent for the Erie at Boston, and one year later was promoted to General Agent for the New England territory. Since 1893 he has been Agent of the Erie Dispatch in New York.

—Mr. Henry B. Hammond, formerly a well known lawyer and railroad officer, died at Chestnut Hill, Mass., on May 31, about 56 years. Mr. Hammond graduated from the Harvard law school in 1861 and after a brief time in the Government service at Washington, D. C., went to Dublin, Ireland, as Consul, remaining there for three years. Returning from New York he engaged in law practice and he continued his law office in New York for many years. Since about 1867, however, he had been chiefly engaged in the organization and management of various railroads. He was Secretary and Attorney for the Union Pacific from 1867 to 1873. While with this company he also became President of the Indiana & Illinois Central. Under his presidency the road was extended across Indiana to Indianapolis. He remained with the road as President and Receiver during the long receiverships and the various reorganizations which it underwent until the organization last fall of the Indiana, Decatur & Western, which now owns the road. Mr. Hammond was, however, connected with other railroad lines, and from 1874 to 1880 was General Manager of the Boston & New York Air Line, which built 50 miles of road between New Haven and Willimantic, now leased by the New York, New Haven & Hartford; since 1880 he had been President of the company. For a brief time, about 1875, he was Vice-President and a Director of the Milwaukee, Lake Shore & Western. He was Receiver of the Chicago, Dansville & Vincennes road; and about 1881 he was President of the Continental Construction & Improvement Co. Mr. Hammond had a stroke of paralysis in 1893, and since that time had practically retired from business. He was well informed on matters pertaining to railroad history and construction and had a valuable railroad library. A few years ago his library of railroad books was classified and a catalogue issued. This embraced the titles of 140 books relating to railroad history, economics, traffic affairs and general railroad matters and 43 bound volumes of pamphlets containing many very valuable and rare pamphlets.

ELECTIONS AND APPOINTMENTS.

Boston, Concord & Montreal.—At the annual meeting of the stockholders at Plymouth, N. H., May 27, these directors were elected: Samuel Kimball, Noah S. Clark, Charles G. Morrison, Lewis C. Pattee, Charles A. Busiel, Hiram N. Turner, Nathan P. Hunt, Fred P. Weeks and Charles H. Bowler.

Cleveland, Cincinnati, Chicago & St. Louis.—At a meeting of the Board of Directors of this company held last week in New York City, the Treasurer, Mr. F. D. Comstock, and the Assistant Treasurer, both now at Cincinnati, resigned their positions. The board then elected Mr. C. F. Cox, Treasurer, and Mr. Frederick Middlebrook, Assistant Treasurer, with offices at the Grand Central Station, New York. Mr. Comstock was then made local Treasurer at Cincinnati.

International & Great Northern.—J. S. Wathen has been appointed Road-master of the San Antonio division, between Palestine and Austin, Tex., vice E. Boles, resigned.

Lehigh Valley.—John W. Skeele has been appointed Special Agent, with office in Western Union Building, Chicago.

Maine Central.—The following appointments are announced: J. L. Spear to be Chief Train Dispatcher, with headquarters at Portland, Me. All the company's lines west of Bangor, including main line and branches, will be under his charge; M. F. Dunn to be Chief Train Dispatcher at Bangor, having in charge all the Maine Central lines east of Bangor. H. F. Dowst has been appointed Division Superintendent of lines east of Bangor, Me.

Mexican Northern.—At the annual meeting of the stockholders of the company in New York City, June 2, the old Board of Directors was re-elected as follows: Robert T. Towne, A. R. Meyer, A. Foster Higgins, N. Witherell, E. M. Shepard, W. F. Dummer and George Foster Peabody.

Missouri, Kansas & Texas.—At the annual meeting of the directors in New York City last week officers were elected as follows: Chairman of the Board and President, Henry C. Rouse; Vice-President and General Manager, Thomas C. Purdy; Vice President, William Dowd; Controller, Secretary and Treasurer, Charles G. Hedge; General Counsel, Simon Sterne.

New England.—The appointment of C. Peter Clark as Assistant General Manager, with office at 180 Summer street, Boston, was formally announced on May 28. The duties of the Assistant General Manager will be the same as those assigned by the Board to the General Manager.

Ohio River.—At a special meeting of the new Board of Directors, held in New York City, on May 28, H. H. Rogers, of New York, was elected President; George A. Burt, of Parkersburg, W. Va., Vice-President and General Manager; W. M. Trevor, of Parkersburg, W. Va., Treasurer; A. C. Bedford, New York City, Secretary.

Pennsylvania Co.—The following Directors were elected at the annual meeting at Pittsburgh, June 2: George H. Roberts, Frank Thomson, John P. Green, Henry B. Welsh, W. M. Barnes, Amos B. Little, N. P. Shortridge, Charles E. Pugh and Samuel Rea, of Philadelphia, and James McCrea, J. T. Brooks, John E. Davidson and Joseph Wood, of Pittsburgh.

Sherman, Shreveport & Southern.—General Manager F. W. Fratt having resigned, that position has been abolished. The offices of manager and superintendent have been consolidated, with E. M. Alford as General Superintendent. The other officers elected are H. N. Marache, Secretary and Treasurer, J. W. Chatham, Freight and Passenger Agent.

Unadilla Valley.—At the annual election held last week, the following Board of Directors was elected: Frederic De Coppet, William Thorne, Benjamin W. Appleton, Clarence Goadby, Frederick F. Culver, Ralph Brandreth and William L. Skidmore. The directors elected these officers: President, Frederic D. Coppet; Acting Vice President, William Thorne; Treasurer, Benjamin W. Appleton; Secretary, Clarence Goadby; General Manager, Frederic F. Culver. Mr. Henry H. Shepard was reappointed Superintendent; Mr. Benjamin W. Appleton, General Freight and Passenger Agent, and Mr. August Graf, Auditor.

Washington, Annapolis & Chesapeake.—Stockholders of the railroad have elected Directors as follows: George E. Emmons, Robinson White, H. O. Emmons, of Washington, D. C.; Gen. Joseph B. Seth, Talbot County, Maryland; Thomas S. Constantine, New York; Robert Moss, Annapolis. George E. Emmons was elected President, Thomas S. Constantine, Vice-President, and Robinson White, Secretary.

Wiscasset & Quebec.—R. T. Rundlett having resigned as President and General Manager, Hon. Henry Ingalls has been elected President, and Hon. W. F. P. Fogg General Manager. Thomas A. Rowe, of Boston, has been elected a director.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Allegheny Valley.—New rails of a heavy section are being laid at various point on the main line. Between Hulton and Mahoning all the curves are being relaid with new rails, and north of Hulton for some miles new rails have been distributed. The entire length of the main line, except a few short sections, is rock ballasted and in excellent condition.

Baltimore & Ohio.—Among the improvements proposed by the receivers and not before mentioned will be the relaying of practically the entire Washington Division with 85-lb. rails replacing the 65 lb. rails now in the track. Contracts for some of the track material for this work have already been given out.

Boise, Nampa & Owyhee.—W. H. Dewey and John E. Stearns have purchased stock of this company, organized to build a road from Nampa and Silver City to De Lamar, Idaho. They have also bought out the Nampa townsite company. The former represents Pittsburgh capitalists who own mines, and who are now building a large mill at Boonville. The latter represents Chicago interests. It is believed this transaction will lead to the construction of the road.

Carolina, Tennessee & Ohio.—Leonard, Foley & Co., of Philadelphia, have been awarded the contract for building and equipping this road from Wilmington, N. C., to Southport, N. C., on Cape Fear Harbor. This contract will include large terminal docks at Southport. The road is projected by H. H. Dougnerty, of Wilmington, N. C. The control of the company is held in Philadelphia, and Mr. J. E. Challenger, Manager of the Philadelphia Car Service Association, is President of the company. His office is in the Provident building, Fourth and Chestnut streets.

Charleston & Allendale.—Contracts were awarded last week to W. B. Strang & Co., of 15 Wall street, New York City, through the Security Construction Co., of Charleston, for building a road between Charleston and Allendale, S. C., about 80 miles. The work included in the contract is to be finished in 120 days. Provisional contracts were made with the same firm for building 175 miles of road west of Allendale after the completion of the road from Charleston to Allendale. It is said that among those interested in the construction company are Messrs. Sol. Haas, Mike Brown, Samuel Thomas and T. F. Ryan. The Port Royal & Augusta and the Port Royal & Western Carolina (now owned by Messrs. Thomas & Ryan), and the Greenwood, Anderson & Western and its extensions, now being built, will, it is said, be consolidated with the new line.

Chicago, Weatherford & Brazos Valley.—This company has been incorporated in Texas to build a road 30 miles long from Weatherford, in Parker County, Tex., northerly through Parker and Wise counties, to intersect with the Chicago, Rock Island & Texas near Paradise or Bridgeport, in Wise County, Tex. The incorporators are: Henry Warren, Charles Barthold, R. E. Bell, R. H. Fant, L. W. Christian, George P. Leary, George A. McCall, J. D. Baker, John Eddleman, Harry K. Kuteman, D. R. Coleman and J. R. Couts.

Duluth Great Western.—This company has been incorporated in Wisconsin to build a line about eight miles in length, connecting the cities of Superior and Bayfield. The capital stock is $100,000, and the incorporators are: George E. Mansfield, of New Hampshire, Caleb S. Cox and I. H. Bradford, of Hubbard, Minn., and John H. Keyes and E. H. Spaulding, of Duluth.

Hendricks, Gladys & Covington.—A charter has been issued in West Virginia to this company, to construct a road to begin near Hendricks, Tucker County, and to extend to Allegheny, Va., near Warm Springs. The line would connect the Chesapeake & Ohio and West Virginia Central & Pittsburgh. The incorporators are A. H. Harper, Sr., J. E. Poling, John W. Moore, James Hamill and Thadeus Harper, all of Hendricks, W. Va.

Little Kanawha Valley.—The final survey is now being made between Parkersburg and Glenville, W. Va. The engineer in charge is Mr. Homer Davis, of Clarksburg, W. Va. The County Court of Wood County, W. Va., a few weeks ago ordered a special election on a proposition to issue $175,000 in county bonds to aid in building the road.

Louisville, Henderson & St. Louis.—Articles of incorporation of this company were filed in Kentucky last week. The company was formerly the Louisville, St Louis & Texas. The capital stock is about $4,000,000, of which $2,000,000 is five per cent. non-cumulative preferred stock.

New East Tintic.—A new project for a road to the Tinctic Mining district of Utah reached the incorporation stage last week, when a charter was filed under this name. The company proposes to build five miles of road, at the Mammoth mine in the Tinctic district. The road is to run from a connection with the Union Pacific, and the Rio Grande Western at Mammoth station, easterly to the Mammoth mill and Mammoth mine, and various adjacent mines. James A. Cunningham and H. S. Young, of Salt Lake City, are directors.

Salt Lake & Pacific.—Chief Engineer McCartney has two parties of engineers out on the line of this road from Garfield, the bathing resort near Salt Lake City, westward by way of Toole and Stockton. He also has a small party on the Utah & California road from the Cedar City coal mines to the old grade built from Milford in 1890 by the Union Pacific.

San Francisco & San Joaquin Valley.—Alexander Mackie, Secretary of this company, announces a meeting of the stockholders to be held at 321 Market street, San Francisco, on June 16 to act upon the proposition to issue first mortgage bonds to the amount of $6,000,000. This issue is proposed to secure funds to complete the construction and equipment of the road to Bakersfield, Cal.

Texas Midland.—The Bethune-Craney Construction Co., of Kansas City, Mo., has been awarded the contract for building the extension from Greenville, north to Paris, Tex.

Toronto, Hamilton & Buffalo.—The contract for the construction of the branch road to connect with the Toronto branch of the Grand Trunk near Hamilton, Ont., has been awarded to Mr. M. A. Pigott, of Hamilton. The cost of the work will be over $250,000.

Electric Railroad Construction.

Allegheny, Pa.—Two electric street railroads organized by Allegheny capitalists, one known as the Pittsburgh & Allegheny Central Street Railway Co., and the second a branch line, the Allegheny & Evergreen Street Railway Co., have applied for authority to build in Allegheny. Among the officers of the two companies are: President, Andrew Poffenbach, and Vice-President, W. L. Hartmeyer. Among the directors are J. G. Eckerman and H. G. Bolster.

Atlantic City, N. J.—The Fairmont Park Transportation Co., of Philadelphia, proposes to build an electric road along the beach front from the iron pier to the inlet at Atlantic City, a distance of about a mile. The feed wires will be placed in a conduit beneath the rails. It is stated that power will be applied or released by the simple pressing of buttons. Work has been begun and the road will be completed before August.

Benton Harbor, Mich.—The Benton Harbor & Eastern Electric Railway has been granted a right of way to enter Benton Harbor through a tunnel. Surveys are being made preparatory to building the tunnel, which is to be three-fourths of a mile long.

Bowling Green, O.—The City Council has passed the ordinance granting the Toledo, Bowling Green & Fremont Railway Co. a 25 years' franchise.

Dedham Centre, Mass.—The West Roxbury & Roslindale Street Railway Co. has petitioned the Selectmen of Dedham to construct an electric road through Washington street, from the Boston line to Dedham Centre, a distance of about 10 miles.

Ellicott City, Md.—The Ellicott City line of the Maryland & Columbia Electric Railway is being rapidly pushed forward by Jones, Pollard & Co., the contractors.

Frederick, Md.—The Frederick & Middletown Electric Railroad Co. has begun the construction of an electric road between Frederick & Middletown, a distance of eight miles. The power will be furnished by the Frederick incandescent light plant.

Hamilton, Ont.—It is proposed to build a road from Hamilton to Alberton, through Ancaster, a distance of 18 miles. The projectors are asking for a bonus of $15,000 when the road is built to Ancaster, and an additional $15,000 when completed to Alberton.

Harrisburgh, Pa.—The Harrisburgh & Mechanicsburg Electric Railway Co. will extend its tracks from Third and Bridge streets to Rosemont.

Indianapolis, Ind.—The Citizens' Street Railroad Co., which now operates 100 miles of road, began an extension of its present line on May 25. The new line will run through Ninth street, Forest avenue, Twenty-Second street, Greenwood avenue and Bellefontaine street.

Milford, Pa.—The contract for the construction of the road from Matamoras to Milford, a distance of six miles, has been given to the Southern Construction Co., of Philadelphia. The survey has been completed between these points and the Construction Co. has contracted to have the road completed by July 15.

Moundsville, W. Va.—Work on the completion of the Moundsville, Benwood & Wheeling Railroad, from Moundsville to Benwood, a distance of 13 miles, has been begun by Receiver Howard Hazlett, of Wheeling.

Nantasket, Mass.—The new system of electric traction by means of power from a third rail was thoroughly tested by officials of the New Haven road at the Nantasket power station on May 24. It has been pretty definitely settled that the overhead system now in use on the Nantasket branch will be abandoned in favor of the third rail, the contracts having already been made for the equipment of part of the line. The application from the car is not made by a wheel, as in the overhead system, but by a shoe, which slides along the top of the rail. The rails are coupled with copper bands, which take the place of fish plates on the ordinary rail, and are bolted to the flanges where they project over the blocks of wood.

New Orleans, La.—It is stated that contracts for the power plant for the Canal & Clairborne Railroad Co. have been let as follows: Boilers to the Edge Moor Iron Co., of Edge Moor, Del.; electric equipment to the General Electric Co., of Atlanta, Ga., and the engine to the E. P. Allis Co., of Milwaukee, Wis.

Pittsburgh, Pa.—Construction work on the new Pittsburgh & Mansfield Railway is to be commenced at once. During the past two years only enough work has been done to save the charter. The cost of the road is estimated at $1,000,000, a large part of which will be expended on the bridge and the tunnel.

The work of changing the Fifth avenue road from cable to electric line began June 1. Nearly 1,000 cars, each equipped with 50-H. P. motors, have been ordered. It is expected to complete the transformation before Oct. 1.

Plattsburg, N.Y.—The Plattsburg Traction Co., was incorporated on May 27 to construct an electric road between Bridge street, in Plattsburg and Bluff Point, about eight miles in length. The capital is $100,000 and among the directors are Henry M. Pierson, Harry G.

Runkle, of New York City; Smith M. Weed, Henry E. Barnard, William L. Pattisson and George Sweet, of Plattsburg.

Portland, Me.—The Portland & Deering Street Railway Co. will extend its tracks to Prides Bridge a distance of about 1½ miles.

St. Louis, Mo.—The Cross County Railroad Co. has filed its certificate of incorporation. The capital stock of the company is $100,000 and among the incorporators are Earnest P. Bell, Mark E. Lennan, Chas. Frederick and Julius Erickson. The new company has received a franchise for the construction and operation of its electric road in the vicinity of Forest Park, St. Louis.

Salisbury, N. C.—The incorporators of the Salisbury, N. C., Electric Light & Railway Co., which was recently incorporated, have transferred the franchise to Dr F. Murdock, who will proceed to build and equip the two miles of new road in the city of Salisbury.

Sioux City, Ia.—The Sioux City Traction Co. proposes to extend its line across the river from South Sioux City to Homer, Neb., a distance of 15 miles. The estimated cost is $100,000.

Sutton, Mass.—Lewis H. Clarke, of the Worcester Engineering Co., Worcester, Mass., is in charge of the construction of 12 miles of road to be built by the Milbury, Sutton & Douglas Electric Railroad Co.

GENERAL RAILROAD NEWS

Atchison, Topeka & Santa Fe.—The company reports the following earnings for April:

	1896.	1895.	1894
Gross earn	$2,203,270	$2,330,391	$2,391,776
Oper. expen	1,614,949	1,916 558	2,003,007
Net earn	$558,321	$383 832	$390.769
P. c. expen. to earn	74⅝	83⅛	83⅝
Net 10 months	6,018,811	5,655,767	8,165,921

The company's net earnings in April, 1893, were $878,949; in 1892, $865,470; in 1891, $758,430; in 1890, $717,960

Baltimore & Ohio.—The receivers' certificates, of which $5,000,000 were authorized by the court, were issued to the extent of $4,000,000 June 1. A syndicate of New York bankers has taken the certificates. The remaining $1,000,000 are held in reserve by the receivers and when issued will also be taken by the same syndicate. The Car Trust certificates, amounting to $3,400,000, will not be issued until July 1. The allotment of these was divided between Baltimore and New York bankers.

Cedar Falls & Minnesota.—At the sale of the road on June 1, the property was bid in by J. S. Hannah, of Chicago, for $600,000. He acted for stockholders of the Illinois Central who held 90 per cent. of the $1,377,000 of the mortgage bonds, interest on which has been defaulted.

Chicago, Burlington & Quincy.—The company reports earnings for April as follows:

	1896.	1895.	1894.
Gross earn	$2,511,758	$2,477,509	$2,495,647
Oper expen	1,732,584	1,668,832	1,655,824
Net earn	$779,174	$808,677	$840,323
P. c. expen. to earn	69	67⅝	66⅛
Charges	880,009	872,954	797,248
Deficit	$100,826	$61,277	Sur. $43,075
Net four mos	3,560,705	3,669,105	3,724,752

The statement for 1896 and 1895 includes the earnings of the Chicago, Burlington & Northern for April of those years. The Burlington earned net in April, 1893, $724,366; in 1892, $683,663; in 1891, $919,489; in 1890, $813,315; in 1889, $822,537.

Chicago, Milwaukee & St. Paul.—The company reports earnings for April as follows:

	1896.	1895.	1894.
Gross earn	$2,366,590	$2,054,183	$2,257,234
Oper. expen	1,590,393	1,318,395	1,517,814
Net earn	$776,197	$735,788	$709 420
P. c. expen. to earn, gross	67¼	63⅝	68⅛
Net earn, 10 mos	$11,321,005	8,340,440	9,527,681

In April, 1893, the net earnings were: $836,453; in 1892, $697,796; in 1891, $596,145; in 1890, $536,331.

Cleveland, Cincinnati, Chicago & St. Louis.—The earnings for April are reported as follows:

	1896	1895.	1894.
Gross earn	$1,096,108	$1,104,682	$1,004,223
Oper expen	794,502	821,571	755,998
Net earn	$241,606	$282,510	$247,315
P. c. expen. to earn	76¾	74⅜	75⅜
Fixed charges	230,740	232,013	228 285
Surplus	$10,865	$50,497	$19.027
Net 10 months	2,921,011	2,813,695	2,729,991

The company's net earnings in April, 1893, were $265,875; in 1892, $267,886; in 1891, $316,486.

Erie.—The company reports earnings as follows for April:

	1896.	1895.	Inc.
Gross earn	$2,389,850	$2,264,080	$125,770
Oper. expen	1825,197	1,718,915	106,282
Net earn	$564,653	$545,165	$19 488
From Dec. 1:			
Gross earn	$11,8 7,593	$11,036,070	$771,523
Oper. expen	9,112 488	8,631,500	480.988
Net earn	$2,695.105	$2.404,570	$290,535

Green Bay, Winona & St. Paul.—Judge Seaman, of the United States Court at Milwaukee, has confirmed the sale of the road, overruling the objections of the minority bondholders. The court ordered part of the purchase money paid into court to protect their interests in case of a favorable decision on appeal.

Interoceanic (Mexico).—The security holders have authorized the directors to borrow $10,500,000 (in addi- to $2,000,000 to be secured on the company's prior lien debenture bonds) and to create and issue $5,750,000 four per cent. debenture stock, $3,700,000 seven per cent. debenture "A" stock and $2,350,000 seven per cent. debenture "B" stock. This is in accordance with the reorganization of the finances ordered recently.

Louisville, St. Louis & Texas.—Aside from settling some of the minor details the reorganization of the road is practically completed. Out of a total of $2,800,000 first mortgage bonds of the old company, holders of $2,729,000 have assented to the plan. Practically all of the second mortgage bondholders have assented. The name of the new company to be formed will be the Louisville, Henderson & St. Louis, and will issue bonds amounting to $2,500,000. five per cent. fifty-year bonds.' Of this issue, $700,000 will be devoted to the improvement of the property, $490,000 especially for extending the line to the city of Louisville, Ky.

Minnesota & Wisconsin.—The foreclosure sale of this road has been adjourned until June 26, the attempt to sell it at the date first fixed in May having been unsuccessful. The road was built a few years ago in Wisconsin by Ex-Senator Sabin, of Minnesota, and now includes about 22 miles of road from Emerald in St. Croix County to Spring Valley in Pierce County, Wis. P. B. Dewey, of Chicago, is the receiver.

Mobile & Birmingham.—A charter has been granted to the new company, and a meeting of the stockholders has been called for June 30, to vote on an issue of $500,000 50-year five per cent. first mortgage bonds. The road was turned over last month to Messrs Edwards & Parsons, of Boston, who bought it in for $200,000 at the foreclosure sale, assuming $169,000 of lease warrants.

Northern Pacific.—The House Judiciary Committee at Washington, D. C., has agreed to a favorable report on the joint resolution permitting the reorganization of the company, which has been in the hands of a sub-committee for several weeks, but striking out the provision which gave the new company the right to reserve any mineral or timber lands, permitting them only to retain the coal mines now in operation. An amendment providing that all the liabilities of the old company from a period dating 12 months prior to the appointment of a Receiver for the old organization should be accepted by the new company, was after some discussion adopted by a bare majority.

The managers of the reorganization of the company announce that a majority of the general first mortgage bonds of the company have been deposited for conversion. After June 30 the basis for conversion will be reduced from 135 per cent. to 132 per cent. in the new four per cent. prior lien bonds of the reorganized company.

The committee, representing bondholders of the Spokane & Palouse Railroad, announce that bondholders may participate in the plan for reorganizing the Northern Pacific up to June 15. They will receive for each $1,000 bond with all unpaid coupons attached $525 in cash on Jan. 1, 1897; $525 in new three per cent general lien bonds, and $250 in new preferred stock of the reorganized company.

Oregon Improvement Co.—The plan of reorganization of the Reorganization Committee, consisting of John I. Waterbury, T. Jefferson Coolidge, Jr., E. Rollins Morse, Edwin S. Hooley and Jules S. Bache, was published this week. This plan provides for the issue of the following new securities: (1) First mortgage five per cent 50-year gold bonds, $5,000,000. (2) Four per cent. non-cumulative preferred stock, $5,000,000. (3) Common stock, $9,000,000. The new first mortgage bonds not set aside for the present firsts are to be issued at no greater rate than the rate of $100,000 a year, and only for the purchase of new steamships and other needed property. First mortgage bondholders receive in cash the coupon maturing June 1, 1896, and 110 per cent. in the new or 5 per cent. bonds, bearing interest from June 1, 1896. Holders of consolidated mortgage bonds, who pay 12½ per cent., or $125 per bond, receive 62½ per cent. in new preferred stock and 75 per cent. in new common stock. Holders of preferred stock, who pay 12½ per cent., or $12.50 per share, receive 62½ per cent. in new preferred stock and 75 per cent. in new common stock. Holders of common stock who pay 10 per cent., or $10 per share, receive 10 per cent in new preferred stock and 50 per cent. in new common stock. A large proportion of all classes of securities and stock have already assented to the plan.

Pennsylvania.—The following table gives the earnings for April for the lines east of Pittsburgh and Erie:

	1896.	1895.	1894.
Gross earn	$5,125.272	$5 2 5.472	$1,764,016
Oper expen	3,834,464	3,694,064	3,366,187
Net earn	$1,290,808	$1,511,408	$1,397.829
P. c. expen. to earn	71R	70⅝	76⅝
Net 4 mos	4,861,928	5,155,328	4.791.806

The Pennsylvania lines east of Pittsburgh and Erie earned net in April, 1893, $1,696,111; in 1892, $1,778,122; in 1891, $1,608,534. On the lines directly operated by the Pennsylvania the April gross earnings decreased $73,200, expenses increased $101,400, net decreased $174,600. For four months gross earnings increased $589,200, expenses increased $648,300, net decreased $59,100. Lines directly operated west of Pittsburgh and Erie report for April: Gross increased, $188,100, expenses decreased $22,100, net increased $210,200. For four months: Gross increased $522,300, expenses increased $365,800, net increased $156,500.

Philadelphia & Reading.—The statement of the railroad company for April is as follows:

	1896	1895.	1894
Gross earn	$1,591,507	$1,649,070	$1,475,259
Oper. exp	899,708	903.367	880,438
Net earn	$691.799	$745.663	$594.821
P. c. exp. to earn	56¼	54¾	59¾
Total income	740,723	787,4 1	629,485
Total charges	829,497	$807.949	$801,751
Deficit	88,774	20,538	172,266
Net earn. 5 months	3,384,579	3.256,737	2,996 599
Deficit 5 months	1,039,927	627,735	1,171 385

The total deficit of the Coal and Iron Co. for the five months this fiscal year was $987,713. In 1895 it was $915,347.

Port Royal & Augusta.—Gen. Samuel Thomas and Thomas F. Ryan, of New York, have purchased a majority of the first mortgage bonds of the road, and the property will be reorganized under their direction. The road is not to be leased to the Central Railroad of Georgia. Under the Constitution of the State of South Carolina such a lease would not be legal. The Central of Georgia, however, owns a large block of the stock and general mortgage bonds of the road.

Washington & Idaho.—Judge Hanford, of the United States Circuit Court, at Seattle, Wash., has signed a decree foreclosing the mortgage held by the Bay State Trust Co., and ordering the sale of the property of the road at Tekoa, Wash. The mortgage was dated Sept 2, 1889, and the entire amount of indebtedness is $2,277,873. The road is one of the leased lines of the Oregon Railway & Navigation Co., owning 1,155 miles of road in Western Washington.

West Jersey & Seashore.—The Company has given notice that on July 1 it will pay off the first mortgage 5 per cent. bonds of the Philadelphia, Marlton & Medford, of which there are $85,000 outstanding, and also the 6 per cent. bonds of the Pleasantville & Ocean City Company, of which there are $80,000 outstanding. Neither of these bond issues has matured. The last-named company's bond can be taken up at any interest period by giving thirty days' notice, and the first-named company bonds can be paid off at any time after July 1, 1896. It is understood that a new 4 per cent. bond is to be issued.

Electric Railroad News.

New York City.—The New York & Harlem Railroad Co.'s Fourth and Madison Avenue horse-car line has been leased to the Metropolitan Traction Co.

Niagara Falls, N. Y.—The main line of the Niagara Falls & Suspension Bridge Railway Co. will hereafter be run by power from the station of the Niagara Falls Power Co.

Painesville, O.—The Painesville, Fairport & Richmond Street Railroad was sold on May 25 at sheriff's sale for $3,160.

Washington, D. C.—The Senate has authorized the Eckington Belt and the Maryland & Washington Railroads to equip their lines within the city limits with pneumatic or other modern motive power, such as the companies may deem best, but neither horse power nor overhead wires shall be used.

TRAFFIC.

Traffic Notes.

The Chairman of the Interstate Commerce Commission has written a letter to the Congressional Committee protesting against the abolition of the imprisonment penalty in the Interstate Commerce law.

The Lake Shore & Michigan Southern now sells round trip local tickets at half rates on Sundays to and from all stations west of Ashtabula, provided the distance and schedules are such that both the going and returning trip can be made on the same day.

The passenger agents are complaining at the unanimity with which the Republican delegates are going for a single presidential candidate at St. Louis, Mr. McKinley. The prospect that there will be no exciting contest at the convention has induced many who intended to go to St. Louis to abandon the trip.

The managers of the Joint Traffic Association have issued a revised circular giving the rates and conditions applicable to lake grain from Buffalo and Erie to Atlantic Coast ports and to places in the interior. The managers have prepared a code of rules concerning excess baggage rates, which is to be put into effect June 8. The basis of rates is 12 per cent. of the highest first-class limited passenger fare.

The Georgia & Alabama has put on an express train each way daily between Savannah and Montgomery. The Southern Railway will, on June 14, put on a through passenger train between Norfolk, Va., and Chattanooga, Tenn., via Selma, N. C., Raleigh, Salisbury and Asheville. The Pennsylvania and the Delaware, Lackawanna & Western now run daily fast trains between Philadelphia and Buffalo by way of Manunka Chunk. The time, through, is about 11 hours, and the trains will have dining cars. The through Chicago and New Orleans train of the Illinois Central, leaving Chicago at 1:35 p. m, now runs via Memphis.

Southern Traffic Association.

The Board of Administration has made a rate of 35c. per 100 lbs. on Bois d'Arc paving blocks from Texas common points to New York, and a rate of 25c. on cottonseed cake and meal, carloads, from Saltillo, Mexico, to Houston and Galveston. An agreement was reached providing that the export rate on wheat to Galveston could be applied upon shipments milled at that point.

Chicago Traffic Matters.

CHICAGO, June 3, 1896.

The rate fight between the Chicago-St. Paul roads and the Lake Michigan Car Ferry Company is on again. All reduced tariffs were canceled May 31, but the Ferry Company immediately reissued its low (50-cent) tariff on north-bound business from Chicago. The Soo seems to have violated its promise to the Northwestern roads not to assist the Ferry Company. On June 2 the Wisconsin Central, the St. Paul and the Chicago Great Western roads met the ferry rates from fourth class down (carload shipments). Next the Lake Superior Transit Company put in a 40-cent tariff which has been met by the Ferry. The Ferry Company says it will continue to take a ten cent differential under any rates that the railroads put in, and the latter are determined to make no concession. The Grand Rapids & Indiana, which runs transfer boats across the lake, announces that it will make the same rates via Mackinac as are made by the Ferry Company.

The trouble over wool rates from the Northwest is still unsettled. The Soo refuses to advance its 44-cent St. Paul-Boston rate, and the Joint Traffic lines are standing out against any reduction from Chicago. The Lake Shore has appealed to the Board of Managers for authority to meet the Soo rate via this city and the Michigan Central has made a similar request to meet the Canadian line via Mackinac. There will be 500 carloads of wool shipped East from St. Paul during the present season.

Chicago officers, especially those of the eastbound lines, are elated over Judge Wheeler's decision in the Joint Traffic case Prominent officers of Western roads say a similar organization among the roads west of Chicago is now a strong probability.

Eastbound shipments via lake last week amounted to 45,931 tons. Total Eastbound shipments via rail, exclusive of live stock last week, amounted to 40,311 tons, compared with 49,305 tons for the preceding week, a decrease of 8,914 tons, and against 38,909 tons for the corresponding week of last year. The proportions of the all-rail shipments carried by each road were:

Roads.	WEEK TO MAY 30.		WEEK TO MAY. 23.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	3 016	7.5	3,578	7 3
Wabash	4 884	12.1	5,732	11.6
Lake Shore & Mich. South.	5,574	13.8	7,453	15.1
Pitts., Ft. Wayne & Chicago	5,331	13.2	5,943	12 0
Pitts., Cin., Chi. & St. Louis	5,046	12.5	6,311	12.8
Baltimore & Ohio	2.941	7.3	4,045	8.2
Chicago & Grand Trunk	5,286	13.1	6,018	12.2
New York, Chic. & St. Louis	3,588	8.9	3 800	7.7
Erie	3,089	7.7	4,317	8.8
C., C., C. & St. Louis	1,553	3.9	2,158	4.3
Totals	40,311	100.0	49,305	100.0

Of the above shipments 1,615 tons were flour, 12,874 tons grain and millstuff, 8,193 tons provisions, 6,761 tons dressed beef, 2,128 tons butter, 989 tons hides and 4,535 tons lumber.